Strategic Sustainability Performance Plan

Submission date: June 30, 2016

Point of contact: NASA Chief Sustainability Officer
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www.nasa.gov
Orion Loaded into Work Stand at Kennedy

Engineers loaded the Orion pressure vessel, or underlying structure of the crew module, into a work stand in the Neil Armstrong Operations & Checkout Building at NASA's Kennedy Space Center in Florida on Feb. 2. The pressure vessel's seven large pieces were welded together at the agency's Michoud Assembly Facility in New Orleans between September 2015 and January 2016. It will fly thousands of miles beyond the moon on Exploration Mission-1.

https://blogs.nasa.gov/orion/2016/02/

New Renewable Energy Goes Online at the Jet Propulsion Laboratory

This solar photovoltaic project for JPL's Building 301 was completed in March 2016. With 864 solar panels and 8 inverters, it can generate about 487,000 kWh annually. The PV project will reduce emission of about 154 tons of carbon dioxide per year and save about $63,000 annually.


Fjord and Glacier in East-Central Greenland

Operation IceBridge uses a highly specialized fleet of research aircraft equipped with innovative science instruments to characterize annual changes in thickness of sea ice, glaciers, and ice sheets. IceBridge is also collecting data to help predict the response of polar ice to climate change and sea level rise. Pictured here is a fjord of Violin Glacier in east Greenland, with Nord Glacier at the upper left corner. The photo was taken on May 19, 2016.


Demonstrating Technologies For Deep Space Habitation

Bigelow Expandable Activity Module (BEAM)

NASA is investigating concepts for habitats that can keep astronauts healthy and productive during missions that take them farther from Earth than humans have ever gone before. Through public-private partnerships with U.S. industry, NASA is evaluating different habitation concepts that can sustain astronauts who are living and working in the harsh environment of deep space.


Testing Technology for Future Earth-Friendly Aircraft

A NASA aeronautics researcher steadies a smoke wand inside the massive National Full-Scale Aerodynamic Complex wind tunnel in order to assess the aerodynamic effects of a series of tiny jets installed on a full-size 757 commercial aircraft vertical tail. Combined with later flights tests on an actual 757, the results proved that the ability to control the flow of air over the tail on demand created enough side force during takeoff and landing that aircraft manufacturers could safely make the tail smaller. A smaller tail reduces weight, drag, and subsequently the aircraft's fuel use and emissions. This and other green-related technologies developed by NASA could cut airline fuel use in half, pollution by 75 percent, and noise to nearly one-eighth of today's levels.

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AGENCY POLICY STATEMENT

The world’s citizens look to the National Aeronautics and Space Administration (NASA) for inspiration and leadership. NASA’s mission is to drive advances in science, technology, and exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of the Earth. NASA leads by example and will continue to spur profound changes in mankind’s knowledge, culture, and expectations. In its Strategic Plan, NASA commits to “environmental stewardship through Earth observation and science, and the development and use of green technologies and capabilities in NASA missions and facilities.” The Strategic Plan adds further that “When we study the Earth from space, we not only reveal the marvelous complexity that enables our planet to support life, but we also gain valuable insight into climate change and weather patterns that translate into better warning and response times for dangerous weather events and natural disasters.”

What began as lofty goals is now being engrained in the day-to-day culture at NASA. In December 2013 the Administrator formally adopted sustainability principles, including climate adaptation. NASA Policy Directive 8500, NASA Environmental Management, states that “NASA will execute the mission without compromising our planet’s resources so that future generations can meet their needs.” The policy directs every NASA employee and organizational element to incorporate environmental risk reduction and sustainability practices into all phases of our work – planning, development, implementation, and operational phases. The policy further directs the implementation of practices to increase energy efficiency, reduce energy consumption and greenhouse gas emissions, increase the use of renewable energy, reduce water consumption, purchase environmentally-preferable products and services, reduce solid waste generation and the use of hazardous materials, increase recycling and diversion of waste materials, build high-performance and sustainable buildings, operate an efficient fleet program, increase electronics stewarding and green engineering, and undertake climate change adaptation and encroachment protection actions. In 2015 the Administrator challenged NASA Centers to look beyond what they have accomplished to date, to envision what is possible, and to bring those ideas to the table. In January 2016 the Administrator went further, requesting the support of the Center Directors, Center cross-cutting Energy Efficiency Teams, and all Center personnel in meeting the challenge of achieving our energy goals. We intend to find solutions previously outside the reach of Centers to provide more effective cost and energy resource usage across the Agency.

To implement this policy and meet the requirements and targets outlined in this plan, NASA will be practical in the integration of sustainability and sustainable practices, supporting the economic growth and livability of our communities. We will look for ways to leverage existing management systems, processes, technologies, and decision-making; to influence both long-term planning and short-term actions. Through these efforts we will enhance and strengthen our ability to perform our mission. We will continue to raise employee awareness and encourage each individual in the NASA community to apply the concepts of sustainability to every aspect of their daily work to achieve these goals. Finally, we pledge to maintain compliance with all applicable Federal, state, local or territorial law and regulations related to energy security, a healthy environment, and environmentally sound operations.

Calvin F. Williams
NASA Chief Sustainability Officer
EXECUTIVE SUMMARY

2016

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VISION

NASA’s sustainability policy is to execute the mission without compromising the planet’s resources so that future generations can meet their needs. In the risk management culture of NASA, that means we endeavor to implement proactive measures to reduce NASA’s exposure to environmental, institutional, programmatic, and operational risks. In doing so, we continuously improve the resilience of NASA’s space and ground asset operations and performance. NASA will continue to integrate sustainability principles into existing policies and procedures to foster awareness, approaches and actions for a more sustainable world. We will also continue to build on the progress toward reducing the risk posed to NASA’s mission by potential energy insecurity, while increasing the cost effectiveness of our scarce resources. Since 1995, NASA reduced facility energy consumption by 26%, resulting in a cost avoidance of nearly $46 million in our fiscal year (FY) 2015 energy bill. Although this is impressive, and a great reflection of the hard work and dedication of our personnel, more remains to be done to maintain NASA’s focus on cost-effective stewardship of our resources.

While the requirements of Executive Order (EO) 13693, Planning for Federal Sustainability in the Next Decade, shape the metrics of our sustainability goals, they do not constrain the scope of sustainability initiatives. Reflecting a desire to design to outcomes, rather than metrics, integration activities already under way at NASA including the following:

- Capability Leaders assess the technical capabilities required to support NASA’s missions and Strategic Goals with a goal to optimize the effective deployment of required assets;
- Master Plans and Capital Investment Plans inform construction and demolition investments to reduce life cycle costs and ensure stewardship of the infrastructure required to support missions and capabilities;
- Building designs recognize operational and mission risks, such as direct mission risks (schedule, cost, technical); safety, security and health; legal requirements; and climate risks (short term, long term, and extreme events);
- Centers assess climate change vulnerabilities with partners in the local community and state and federal neighbors;
- Centers develop plans and strategies to incorporate technologies and best practices that will enable them to identify and execute the most cost effective energy initiatives, which will improve our energy security and reduce our total life-cycle costs in support of our missions;
- NASA plans to develop a 10-year Strategic Energy Investment Plan to achieve the annual energy goals for Centers; and
- The land management policy incorporates flooding risks into evaluations of investments to create or renew facilities.

In addition to these ongoing actions, NASA is focusing on other activities that will contribute to positive trends in the Strategic Sustainability Performance Plan (SSPP) goals.

**NASA is focusing on its Critical Infrastructure Security.**

NASA continues to strive to increase resiliency of our missions through sustainability practices. Threats to sufficient supplies of necessary energy and water and disruptions to their distribution systems can disrupt mission critical facilities and operations at NASA Centers and international locations. NASA will perform facility energy and water security assessments to identify threats and vulnerabilities to its industrial
management systems, energy/water infrastructure and supply (including supply diversity) to ensure that reliable and resilient capabilities and assets are available to carry out critical missions. Specifically, NASA is assessing the reliability and continuity of water supply to our facilities located in western regions facing continued drought by performing a climate risk management survey regarding water use, resources, and conservation measures. The survey will support development of climate risk management strategies.

*Early NASA policy on green buildings is manifesting itself now.*

Several years before the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding was issued, NASA set a policy that projects planned for FY 2006 and beyond meet the minimum Leadership in Energy and Environmental Design (LEED®) rating of Silver and strive to meet LEED® ratings of Gold. In FY 2015, NASA added six buildings, with a combined area of more than 547,000 gross square feet (GSF) to its portfolio of buildings meeting the Guiding Principles for High Performance and Sustainable Buildings. One facility received LEED® Gold certification and the other five received Silver. It is anticipated that NASA will exceed 3 GSF of sustainable facilities in FY 2016 with the certification of several buildings under construction and one existing building in performance review. Although the six new sustainable buildings represent only about 1% of the 47.3 million GSF in NASA’s total portfolio, the other important part of the story is the demolition of excess assets. NASA continues to follow its Reduce the Footprint approach, demolishing underutilized and/or unsuitable space to make way for more efficient building stock. Of the total portfolio of 47.3 million GSF, less than a third (15 million GSF) are considered Administration Space (Offices or Storage). In FY 2015 about 700,000 GSF of administration space was demolished, ranging...
from small storage buildings to large administration buildings. This is greater than the square footage added as new sustainable buildings in FY 2015.

**Internal partnership continues to yield better understanding of climate risks.**

In 2005 NASA recognized the risk to space operations and ground systems from climate and extreme weather; in response, NASA set up a partnership between its Strategic Infrastructure and Earth Science organizations in 2010. Climate experts have been collaborating with institutional stewards to define, explore, and address adaptation issues ever since. The partnership has featured a series of interactive, local, climate-focused workshops at NASA Centers across the nation.

Building on localized climate data and projections (for NASA Centers) developed by NASA’s Goddard Institute of Space Studies, climate science experts from across the Agency work to equip NASA’s leadership, workforce, and institutional stewards (facilities and environmental managers and emergency planners) to make prudent, climate-aware decisions, and better understand the local implications of climate change on bio-diversity, storm surge, and surface water cycles to develop adaptation actions. New extreme weather and seasonal climate projections developed this past year are providing more detailed information useful in facilities planning and asset management processes. Asset stewards at NASA Centers, working with a spectrum of public, private, and academic external stakeholders, define current and future climate risks, develop adaptation strategies, and integrate climate considerations and solutions into existing management processes.

NASA scientists will continue to leverage enhanced, localized climate projections for its Centers based on updated climate models. Institutional stewards will continue to use such information to refine their risk management processes to ensure a resilient U.S. space transportation capability and to safeguard its capabilities against loss. NASA promotes learning and on-the-ground progress in climate-aware institutional management both internally and when interacting with others.

**NASA achieved its 2016 target for the President’s Performance Contracting Challenge.**

NASA awarded $114.3M investment value in Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs) through March 2016. This surpasses by $40.4M our President’s Performance Contracting Challenge pledge to award $73.9M by the end of 2016. Under Phase 2 of the Challenge, NASA awarded four projects including the Agency’s first combined heat and power (CHP) system. The CHP ESPC represents the largest investment value energy performance contract ever awarded by NASA.

In response to EO 13693’s challenging energy goals, NASA initiated an effort to develop a Strategic Energy Investment Plan with Department of Energy and industry support. The Strategic Energy Investment Plan will provide information to help NASA senior leaders understand and prioritize energy efficiency, renewable electric energy, and clean energy opportunities across the Agency in support of NASA’s mission and greenhouse gas (GHG) emission reduction goals. Because the planning will occur during FY 2016 and FY

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**Aeronautics Research Mission Directorate**

**Researches Electric Propulsion-Powered Aircraft**

NASA is researching ideas that could lead to developing an electric propulsion-powered aircraft that would be quieter, more efficient and environmentally friendly than today’s commuter aircraft. The proposed piloted experimental airplane is called SCEPTOR, short for Scalable Convergent Electric Propulsion Technology and Operations Research. The concept involves removing the wing from a Tecnam P2006T, a general aviation-sized aircraft, and replacing it with an experimental wing integrated with multiple electric motors. SCEPTOR could be a solution to greater fuel efficiency, improved performance and ride quality, and reduced aircraft noise. SCEPTOR also is part of NASA’s efforts to help pioneer low-carbon propulsion and transition it to industry.
2017, NASA is refraining from setting energy performance contract investment value targets for FY 2017 and FY 2018 in this 2016 SSPP.

LEADERSHIP

NASA continues to boldly pursue missions no other organization can match – we are launching a new initiative to accelerate aviation energy efficiency, transform propulsion systems, and enable major improvements in safety and mobility, we continue to test and assemble the James Webb Space Telescope for launch in 2018, and we are making strides toward our goal for sending American astronauts to Mars in the 2030s. NASA’s leadership embraces sustainability as a means to enable and enhance resilience of NASA’s mission efforts. Sustainability has been incorporated beyond NASA’s environmental management leadership as an Agency policy and requirement. Sustainability is integrated into delivering mission success through the Agency’s master planning, procurement, communication and computing technologies, its infrastructure design, construction, and deconstruction of capabilities no longer required, in prioritization and budgeting of space mission assets, and in drafting Agency policies. By leveraging partnerships with international, intergovernmental, academic, industrial and entrepreneurial communities, NASA is improving mission assurance and resilience. These partners contribute innovation and technology to NASA’s mission and extend sustainability principles globally.

In April 2015, Administrator Bolden named his Assistant Administrator (AA) for the Office of Strategic Infrastructure (OSI) as NASA’s Chief Sustainability Officer. The OSI provides executive and functional leadership, policy, technical expertise, and oversight for Agency infrastructure including facilities engineering and real property, environmental management, logistics management, aircraft management, strategic capabilities assets program, and integrated asset management. The Office’s mission is to ensure that the right infrastructure assets and capabilities are available in the timeframe needed to support the Agency’s mission. The AA’s role, responsibility, and authority as senior leader of the OSI align well with duties as NASA’s Chief Sustainability Officer. The Center Sustainability Officers (CSOs), in many cases, parallel the responsibilities of the Chief Sustainability Officer at the Center level, thus extending accountability from the Agency to Center level.

The Chief Sustainability Officer and CSOs consider infrastructure asset decisions to be a prime focus area to ensure NASA’s sustainability. Recent revisions to master planning policies and a new land management directive compel institutional stewards at the Agency and Center levels to carefully evaluate risk factors.

Human Exploration and Operations Mission Directorate Solves a Solvent Problem

Liquid oxygen (LOX) propulsion systems for the Space Launch System (SLS) require a high level of cleanliness to avoid potential reactions that could lead to fire or explosion. Solvents used to clean oxygen systems and test hardware must be compatible with materials in these systems. Hydrochlorofluorocarbon (HCFC)-225 solvent was successfully used on the Space Shuttle and was transitioned for interim use on the SLS Program. But HCFC-225 is an ozone-depleting substance and has been phased out of production. An extensive evaluation and replacement test effort performed by Marshall Space Flight Center engineers in conjunction with Stennis Space Center and the White Sands Test Facility led to the identification of Solstice® Performance Fluid (PF) as an alternative solvent that meets or exceeds performance requirements. Solstice® PF breaks down rapidly in the atmosphere and fully meets all currently identified environmental requirements and goals including having a very low global warming potential.
relating to capital investments. New facility design guidelines take climate into account and Center-level climate change vulnerability assessment activities enable better capital investments.

Because achieving the energy goals for EO 13693 will require more aggressive energy investments, in 2015 Administrator Bolden challenged NASA Centers to use cross-cutting approaches to meet these energy goals, and in doing so, improve the cost effectiveness and mission capabilities of NASA.

The Chief Sustainability Officer meets quarterly with the Sustainability Officers from each Center to review policies, share best practices and coordinate on issues.

**HQ Sustainability Working Group (SWG) coordinates sustainability implementation, with valuable Center contributions**

The goal of the Headquarters (HQ) SWG is to ensure an integrated strategy towards sustainability across the Agency, leveraging existing programs and teams. The SWG team is led by NASA’s Chief Sustainability Officer and is composed of HQ leaders from each appropriate community of practice area. These HQ leaders coordinate Center activities to achieve goals, objectives, and targets contained within the annual SSPP. The HQ SWG meets every two weeks during the update of the SSPP and has representatives from many NASA offices – OSI, Office of Procurement, and Office of the Chief Information Officer. More broadly, perspectives of other organizations (for instance the Chief Financial Officer, General Counsel, or Mission Directorates) are consulted to ensure alignment, enabling sustainable progress. Thus the SWG includes participants with concerns broader than institutional infrastructure.

Successful implementation of NASA’s sustainability vision and goals relies on individual leadership as well as the activities and leadership of multiple cross-Center teams. While the SWG ensures an integrated strategy towards sustainability within NASA, most of the work towards sustainability is executed by the Center level workforce. Because NASA is geographically dispersed, creating cross-Center teams has been an important method to spread and strengthen best practices across the NASA community. Many diverse disciplines and functional areas are needed to achieve all of the goals, requirements, and targets associated with sustainability. To execute, NASA has well-established communities of practice – energy, water, transportation, recycling and sustainable acquisition, design and construction, maintenance and operations, master planning, climate change adaptation, electronic stewardship, and others. The pursuit of more sustainable practices requires the integration and coordination of these discipline-focused teams.

NASA will continue to draw upon the creativity, experience and initiative of its workforce and partners to achieve NASA’s mission, integrate sustainability into the NASA work ethic and enable the Agency to meet the goals and challenges of the Strategic Sustainability Performance Plan. NASA will also collaborate with both domestic and international partners to find new ways to implement sustainability.
### NASA Performance on FY 2015 Sustainability Goals

**Goal 1 | Greenhouse Gases**
- Reduce direct GHG emissions (onsite or offsite) by 18.3% by 2020 and reduce indirect GHG emissions (e.g., commuting, travel) by 12.3% by 2020, compared to 2008

**Goal 2 | Sustainable Buildings**
- Reduce facility energy intensity (energy consumption/GSF of building area) by 30.0% by end of FY 2015, compared to 2003
- 15% of building square footage meets Guiding Principles by end of FY 2015
- 15% of number of buildings meets Guiding Principles by end of FY 2015

**Goal 3 | Renewable Energy**
- 7.5% of agency’s total electricity consumption is from renewable energy sources

**Goal 4 | Water Use**
- Reduce potable water use intensity (gal/GSF) by 2% each year, compared to 2007; reduce use for industrial, landscaping, and agricultural by 2% each year, compared to 2010

**Goal 5 | Fleet Management**
- Reduce petroleum consumption by 2% annually, compared to 2005; increase use of alternative fuels by 10% annually through FY 2015

**Goal 6 | Sustainable Acquisition**
- 95% of contracts meet federal mandates for acquiring products that are energy efficient, water efficient, biobased, environmentally preferable, non-ozone depleting, recycled content, or are non-toxic or less toxic alternatives

**Goal 7 | Pollution Prevention & Waste Reduction**
- Divert 50% of solid waste (excluding construction and demolition debris); divert 50% of construction and demolition debris

**Goal 8 | Energy Performance Contracts**
- Award $73.9M investment value in Energy Savings Performance Contracts and Utility Energy Services Contracts by the end of 2016

**Goal 9 | Electronic Stewardship & Data Centers**
- Procure energy-efficient equipment rated per Electronic Product Environmental Assessment Tool (EPEAT); use best practices for computer operation and disposal

**Goal 10 | Climate Change Resilience**
- Evaluate climate change risks to identify and manage the effects of climate change on the agency’s operations and mission in both the short and long term
Summary NASA seeks an integrated approach to reducing GHG emissions, including:

- reducing building footprint and building energy consumption;
- integrating sustainability principles when building and renewing facilities;
- managing facilities more sustainably;
- leveraging emerging technologies and funding strategies to advance energy conservation and sourcing;
- managing a leaner, cleaner vehicle fleet; and
- using technology and a mobile workforce to minimize Scope 3 emissions.

NASA integrates these diverse approaches across its network of Centers through its Center Sustainability Officers as guided by its Chief Sustainability Officer. The network is supported by Agency-level functional managers and distributed communities of practice, developing policy and guidance, establishing priorities, formulating budget recommendations, monitoring progress, and sharing best practices and lessons learned.

NASA collects comprehensive, robust data to inform its emissions projections. Centers provide energy and sourcing data for tracking Agency progress via an on-line tracking system, to which NASA is adding Agency- and Center-level analytics capabilities. NASA uses such data to understand the patterns in its energy consumption and sourcing, considering both routine and mission-variable activities in seeking overall reductions. The Agency recognizes that in any given year, necessary mission ramp-ups may offset other progress.

NASA seeks innovative partnerships with utilities and energy services companies to green its energy sourcing and reduce its energy consumption.

NASA both invests in mobility-enabling technologies and promotes telework to reduce emissions resulting from employee commuting and business travel, and expects these programs to further reduce emissions as they are more fully integrated into NASA’s cultural norms.

Planned Actions: NASA will advance its efforts to continue reducing its GHG emissions. Scope 1 and 2 particulars include investing in more efficient building equipment (boilers, generators, and furnaces), increasing its use of renewable energy, replacing or renewing inefficient legacy buildings to standards that exceed required levels of efficiency, reducing its facilities footprint to the maximum extent practical, and constructing a combined heating and cooling facility at its Johnson Space Center. NASA is also investigating means of reducing its emissions by substituting chemicals that emit fewer GHGs.

NASA expects continuing technology investments and advancing management practices to reduce Scope 3 emissions this year, and is developing a Multi-Modal Access Commuter Plan to spur additional change in the longer term. NASA will investigate the potential for leveraging partnerships with the EPA, GSA, Federal Executive Boards and others to seek out additional collaborative opportunities to reduce the emissions relating to employee travel patterns.
Reducing Energy Costs and GHG Emissions

Stennis Space Center (SSC) has a very robust energy management control system (EMCS) that monitors and manages the heating and cooling equipment in most of the NASA-occupied buildings at SSC. During FY 2015 an EMCS Team continued to develop and implement strategies for using the EMCS to further reduce energy consumption in buildings. This was accomplished by modifying the sequences of operation to include energy efficient control strategies without affecting building comfort. These modifications included:

- reset strategies for chilled water flow, supply air static pressure, and temperatures for supply air, heating water, condenser water, and chilled water;
- using outside air for cooling in lieu of mechanical cooling (economizer);
- modifying equipment operational schedules to better match occupancy schedules; and
- minimizing or eliminating simultaneous heating and cooling.

This program has proven to be highly successful. Through FY 2015 the ongoing program has realized over 33 billion BTUs in annual energy savings and over $400,000 in annual energy cost savings. Consequently, NASA prevents 3,250 metric tons carbon dioxide equivalent (MTCO2e) GHG emissions from entering the atmosphere each year; this equates to the total annual GHG emissions of 343 average U.S. homes. And because the personnel and equipment were already in place to implement this program, the additional cost to NASA for these savings was zero dollars.

Goal 2 | Sustainable Buildings

- Reduce facility energy intensity (energy consumption/GSF of building area) by 30.0% by end of FY 2015, compared to 2003
- 15% of building square footage meets Guiding Principles by end of FY 2015
- 15% of number of buildings meets Guiding Principles by end of FY 2015

Status as of September 30, 2015

- 27% reduction in facility energy intensity
- 19.7% of gross square footage of inventory meet the Guiding Principles
- 12.8% of the number of total buildings meet the Guiding Principles

Summary

NASA has always constructed facilities to meet its mission with the most efficient use of space and funding. NASA continues to make progress on its energy intensity and sustainable building goals albeit scoring ‘yellow’ in both metrics. The latter goal is measured both by the number of buildings and gross square feet (GSF) of buildings meeting the Guiding Principles. In FY 2015 NASA added 547,300 GSF of facilities that meet the Guiding Principles, thus achieving 19.7% of its inventory meeting the principles when measured by GSF. The FY 2015 amount more than doubles the GSF of sustainable space when compared to the previous fiscal year. NASA completed the revision of its original Sustainable Facilities training course in early FY 2016.
following the release of the revised Guiding Principles and provided two on-site training sessions in February and April 2016. Because this goal contains multiple components relating to green buildings, building energy intensity, master planning, and Energy Savings Performance Contracts, coordination and integration occurs across several NASA Headquarter-Center groups. These teams contribute to NASA’s Energy Management and Sustainable Facility management strategies, updating internal requirements and guidance documents and providing the coordination and outreach necessary to achieve the goals of the EO. NASA tracks its energy goals through the Annual Department of Energy (DOE) Energy/Water report, Semi-Annual OMB Scorecard, DOE Compliance System reporting on energy/water consumption, energy conservation measure (ECM) implementation and tracking, and building benchmarking. In addition, HQ representatives participate in Interagency working groups and task forces. NASA’s updated master planning requirements and recently issued Handbook for Master Planning (containing specific reference to sustainable site development and stewardship practices) position the Agency for master plans that enable a more strategic, sustainable building set.

**Challenges** The energy intensity goal contains an inherent conflict between competing goals - reducing our footprint (GSF) and reducing energy intensity (BTU/GSF). Although demolishing or mothballing facilities based upon mission requirements reduces overall energy usage, the resulting reduction in overall square footage raises the energy usage per square foot. Additional challenges this year in meeting the energy intensity goal were colder than average weather conditions and a need to utilize natural gas at times rather than landfill gas (considered a renewable energy source, which does not count in this metric). With regard to the Guiding Principles goal, NASA has a long-standing strategy to maximize the use of its existing facilities while constructing new facilities to meet its mission in the most cost effective methodology. This *Repair by Replacement* strategy maximizes current budget funding to economically construct new sustainable energy efficient facilities, reduce the facility inventory and Agency footprint, and provide a total building renovation to those facilities that, when assessed, provide the most favorable conditions to meet the Guiding Principles. Less intensive renovations to “existing” buildings (i.e., constructed before the Guiding Principles were issued in 2006), although contributing to energy conservation goals, typically do not meet the Guiding Principles. Thus, NASA has only two pre-2006 “existing” facilities with 290,000 GSF that meet the Guiding Principles, with a third facility consisting of over 200,000 GSF in size, currently in performance review. An additional challenge is that the current metric requires a minimum building size of 5,000 GSF to be included in the goal metric calculation. This minimum building requirement prevents NASA from including another five buildings that could have been used to meet the goal metric for number of buildings meeting the Guiding Principles. As of the end of fiscal year 2015, NASA had 41 LEED-certified buildings (all greater than 5,000 GSF) that meet the Guiding Principles in accordance with EO 13693.

**Planned Actions** NASA Centers will continue to partner with utility companies and energy service companies to implement the awarded projects and conduct assessments and audits leading to proposals for potential additional projects. NASA plans installation of combined heat and power systems at three candidate Centers, depending on the results of feasibility studies, to increase energy efficiency, reduce GHG emissions, and improve energy security. NASA Procedural Requirements (NPR) 8831.2E, *Facilities Maintenance and Operations Management*, is in final review. It includes updates to relevant areas including energy and water use reduction and building commissioning to effectively and more efficiently operate and maintain NASA facilities. By the end of FY 2016, NASA is planning to have several newly constructed facilities and a third existing building, totaling over 500,000 GSF, meeting the Guiding Principles. In May of FY 2016, NASA HQ Facilities and Real Estate Division (FRED) hosted the biennial Facilities and Real Estate Conference with the theme, *Managing NASA’s Infrastructure for Tomorrow’s Missions*. The conference, hosted at the Glenn Research Center, was attended by employees representing NASA leadership, real estate, planning, energy, O&M, design and construction, and environmental offices from all 10 NASA Centers and HQ. The conference
focused on a number of facilities-related policies, procedures, and best practices with primary tracks including Infrastructure Resilience, Real Estate, Operations and Maintenance, Facility Management Tools, Design and Construction, and Energy. One of the plenary topics was the NASA Strategic Sustainability Plan. These topics will enable managers to effectively implement our planned actions.

**Success Examples**

- Six buildings added or modified in FY 2015 with a combined area of 547,300 GSF, met the Guiding Principles; one facility received LEED® Gold certification and the five others attained LEED® Silver certification.
- A newly constructed 153,000 GSF facility achieved LEED® Silver in FY 2015 and received the additional Green Building Initiative® sustainable rating of 2 Green Globes. This is the first NASA facility to receive 2 different sustainable ratings, LEED® Silver (USGBC) and 2 Green Globes (GBI).
- It is anticipated that NASA will exceed 3 million GSF of sustainable facilities in FY 2016 with the certification of several buildings currently in construction and one existing building in performance review.
- Goddard Space Flight Center is conducting Chiller Plant Optimization and HVAC improvements projected to result in a 1.6% reduction in combined energy intensity at its Greenbelt and Wallops Facilities.

**Building 4220 Goes for the Green**

Marshall Space Flight Center (MSFC) completed construction of its new Building 4220, a sustainable office building earning LEED® Silver certification. A first for NASA, the building also garnered two Green Globe awards from the Green Building Initiative® in recognition of its many environmentally friendly features. The building houses the Space Launch System Program office. It uses 30% less energy and 30% less water than typical office buildings; it uses energy efficient lighting with occupancy and daylighting sensors. The 20,000 gallon underground cistern will store rainwater for use in irrigation.

**Aircraft Landing Dynamics Facility Track Demolition and Conversion to Green Space**

In an effort to reduce unneeded and outdated infrastructure, Langley Research Center (LaRC) has implemented an aggressive demolition program. Each demolition project goes through an environmental review process to ensure that construction and demolition (C&D) debris is recycled to the maximum extent possible. In 2015, approximately 9,600 cubic yards of C&D debris from previous demolition projects were diverted from landfills to be used as material to fill the 2,800 foot long test track trenches at the recently demolished Aircraft Landing Dynamics Facility (ALDF). This fill material included concrete, brick, and asphalt.

If LaRC had not used the 9,600 cubic yards of C&D debris (brick, concrete, asphalt) as material to fill the trenches for the demolition of the ALDF track, it is estimated that it would have cost LaRC at least $136,000 to landfill this waste. Additionally, it avoided costs of $167,000 since LaRC did not need to purchase and haul fill material from an outside source. Combined, this project resulted in over $303,000 of total cost savings for LaRC.
The demolition and conversion of the ALDF facility also yielded a 4.61 acre reduction of impervious surfaces. Since these areas were converted to a pervious surface (green space), this project has improved storm water quality, decreased storm water quantity (runoff), and increased habitat. Quantifiable storm water benefits from converting 4.61 acres of impervious to pervious land use includes annual reductions of 27.9 pounds of total nitrogen, 5.4 pounds of total phosphorous, and 1980 pounds of total suspended solids from Brick Kiln Creek.

Summary NASA successfully exceeded this fiscal year’s goal of 7.5%, building on NASA’s Agency-wide strategy of emphasizing identification of large projects that can make a significant difference for the Agency, in addition to initiating smaller projects at each Center. Centers are trying to bundle solar projects with larger facility upgrades or ECMs to reduce payback periods. More than 75% of NASA’s renewable electric energy is from renewable energy credit (REC) purchases; about 11% comes from direct purchases. NASA completed its feasibility study for a solar plant installation at one facility and awarded a contract for a 1.6MW solar installation to be completed at the end of calendar year (CY) 2016 or early CY 2017. This solar project will provide renewable power and peak shaving for a groundwater remediation system, reducing significant energy costs over a long period of time, and provide energy security for critical facilities. NASA is a member of the Federal Energy Management Program (FEMP) Renewable Energy Working Group and contributed to the development of the FEMP Playbook for Large-Scale Renewable Energy Projects. NASA completed revision of its Energy Management Program procedural document and associated Energy Guidance Handbook. The NASA Energy Efficiency Panel (EEP) initiated a subcommittee to evaluate NASA’s renewable energy program, and submit recommendations to the EEP. The recommendations will be considered in Agency wide planning of strategic renewable energy investments.

Challenges NASA continues to address issues relating to the lack of authority to enter into long term (10+ years) Power Purchase Agreements (PPAs) with vendors for renewable energy contracts (unless within an ESPC). In addition, an OMB policy - ‘the Federal government must retain title to the installed capital goods at the conclusion of the contract’ - lessens the financial incentive of third party investors or providers to enter into ESPCs with a renewable energy component1. NASA is working through the National Renewable Energy Lab (NREL) to resolve these issues. Furthermore, although NASA is successfully using several renewable energy technologies - solar thermal, geothermal, and steam generation from renewable sources – some of these renewables energies cannot be counted in the renewable energy metric because they do not generate electricity. The Energy Policy Act of 2005 requires that no less than 7.5% in FY 2013 and thereafter of total electricity consumed by the Federal Government come from renewable energy. EO 13693 has increased renewable energy requirements and NASA is reviewing its renewable energy policies regarding this new requirement. Unless barriers to implement on-site renewable energy generation are removed, NASA may not be able to meet the new requirements as REC costs increase and budget limitations affect the purchase of a sufficient number of RECs needed to meet this new challenging goal.

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1 OMB Memorandum M-12-21 dated 9/28/2012, Subject: Addendum to OMB Memorandum M-98-I3 on Federal Use of Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs)
**Planned Actions** NASA will continue to work with DOE, FEMP, NREL, and other agencies to implement renewable energy projects by installing onsite renewable energy at its Centers. NASA completed a Phase 2 feasibility study for a second CHP project (NASA’s first CHP project is at Johnson Space Center, discussed in Goal 8), which could produce roughly 95% of Goddard Space Flight Center’s electrical power by using landfill gas supplemented with natural gas. The study is currently under review; however, high implementation costs may prevent NASA from following through on this project. Another facility continues to work on incorporating a solar project into their Energy Savings Performance Contracts (ESPC). NASA is considering buying RECs at the HQ level, with Centers providing funding according to their local electricity use and other renewable resources. Each Center is developing a vision for meeting the aggressive goals of EO 13693. Meanwhile, an Agency-level Strategic Energy Investment Plan is under development for mid-FY 2017 completion.

**Success Examples**
- NASA Centers are including renewable energy projects in ESPC projects to leverage high capital investment and average out long payback periods.
- White Sands Test Facility awarded a contract to install a 1.6 MW solar system using recycling funds and NASA HQ funding. This system will provide renewable power to operate a groundwater remediation system and also provide energy resiliency to a water supply system during extended power outages.

**NASA Harnesses the Sun**

NASA recently awarded several design or construction contracts for photovoltaic (PV) systems at NASA Centers. These include construction of a 2 MW system at Kennedy Space Center, design of a 1 MW rooftop system on a parking garage at the Jet Propulsion Lab, and a 1.6 MW system at the White Sands Test Facility in New Mexico. The up to 2 MW solar farm expansion at Kennedy will be built on six acres of land adjacent to the existing 1 MW facility. The expansion is intended to make Phase 1 (200,000 GSF of office space under construction) of Kennedy’s Central Campus a net-zero energy facility. The JPL system, featured on the front cover of this report, generates approximately 487,000 kilowatt-hours per year, saving 154 tons of CO$_2$ emissions and about $63,000 per year. The White Sands solar plant will provide power to the Ground Water Remediation System, reducing energy costs and GHG emissions. The solar plant will also provide energy and water security to the water supply system for the facility during extended power outages. Construction is planned to start around mid-2016.

**Goal 4 | Water Use**
- Reduce potable water use intensity (gal/gsf) by 2% each year, compared to 2007; reduce use for industrial, landscaping, and agricultural by 2% each year, compared to 2010

**Status as of September 30, 2015**
- Reduction of potable water intensity since 2007 is 36%
- Reduction of water for industrial and landscaping since 2010 is 82.5%

**Summary** NASA is well beyond the goal for potable water intensity reduction with reductions achieved thus far of 36% versus the goal of 26% by FY 2020; NASA also exceeds the industrial, landscaping, and agriculture water reduction goals. The Agency continued to implement major water infrastructure upgrades by replacing aging distribution systems to address leaking pipes, install meters, retrofit bathroom fixtures and reduce the use of landscaping water systems at multiple Agency sites in FY 2015. NASA uses its annual DOE Energy/Water report, semi-annual OMB Scorecard, the NASA Environmental Tracking System (NETS) database, and results from triennial Environmental and Energy Functional Reviews and internal Baseline Performance reviews to track water use. NASA integrates water conservation into planning efforts through regularly scheduled meetings with the Center Sustainability Officers, Environmental Management Panel, Energy Efficiency Panel,
the Sustainability Working Group, and the Community of Practice for Energy/Water. Centers are responsible for installing water efficient technologies in all new buildings and upgrades/maintenance of existing buildings. They conduct water conservation audits and leak detection programs and these efforts have resulted in water distribution system repairs at several Centers. NASA Centers are responsible for reducing the use of landscape irrigation to reduce water use, while considering safety (e.g., fire protection) and mission requirements. Many Centers, particularly those located in western states, already use water-efficient landscaping. NASA Centers review their current systems and deploy water closed-loop, capture, recharge, and/or reclamation systems as appropriate. Many Centers have already converted equipment to closed-loop systems and several Centers have partnered with local communities to use reclamation systems. Centers are also responsible for reviewing industrial and landscaping uses (no agricultural water uses) and installing meters where justified. Centers have some industrial and landscaping water uses, but most of this type of usage has historically been captured under potable water use. Landscaping is often associated with a building and is part of that building’s water use. Some of the industrial water uses may merit separate metering and this will be evaluated. Repair and rehabilitation of distribution systems often requires significant construction effort by NASA Centers as typically large sections of the aging systems need to be replaced.

**Planned Actions** NASA is assessing the reliability and continuity of water supply to our facilities located in western regions facing continued drought, performing a climate risk management survey regarding water use, resources, and conservation measures. The survey will support development of climate-risk management strategies. NASA Centers will continue to assess their water distribution systems, conduct leak detection audits, and replace/repair components, as appropriate, considering available resources. NASA Centers will continue to evaluate utilizing or expanding the use of water-efficient landscaping to reduce water use. For industrial water uses, NASA will continue to evaluate the need for additional metering. Centers will also continue to assess whether it is appropriate to deploy additional water closed-loop, capture, recharge, and/or reclamation systems.

**Success Examples**

- Goddard Space Flight Center partnered with the University of Maryland Extension to begin developing a demonstration meadow, in place of pre-existing decorative planting, as part of a practicum course for master gardening students. This project serves to pilot a landscaping strategy that will provide greater storm water management capabilities and conserve natural pollinator habitat with minimal maintenance needs.
- Upgraded water distribution system at several Centers, which resulted in reduced flushing to maintain water quality standards.
- Installed water meters, which are being reported through the Center Building Monitoring Information (BMI) System.
- Optimized cooling tower operations.
A New Landscape Look for the Jet Propulsion Lab

Responding to the continuing drought conditions in California, JPL developed a Landscape Plan calling for the conversion of some of its traditional landscapes to xeriscapes. The effort was reinforced with Lab-wide communications articles and emails. On-site mulch generation helps reduce evaporation rates. The pictures to the right illustrate BEFORE and AFTER landscaping at one building. Xeriscaping around this building yields about 50% water savings; landscape irrigation reductions and xeriscaping landscaping have yielded 35% water savings at JPL since 2007.

Summary

NASA updates its Fleet Management Plan each fiscal year to ensure actions support current petroleum reduction and GHG emission goals. Continued execution of NASA’s Fleet Management Plan maintains the following objectives: a) optimize use of the vehicle fleet; b) acquire and/or adjust the size and functional utility of each vehicle to match the program’s needs and/or mission’s requirement (right sizing the vehicle fleet); and c) acquire Alternative Fuel Vehicles (AFV), Flex Fuel Vehicles (FFV), Low GHG emitting and Zero Emission vehicles during “end of life cycle” replacements. NASA Center Transportation Officers (CTOs) manage and control all assigned vehicles and annually evaluate NASA’s vehicle fleet for both existing vehicle assignments and new requests for transportation support. In FY 2011 Vehicle Utilization Review Boards (VURBs) projected a 10% reduction in vehicle fleet assets through FY 2015, and NASA represented this projected reduction as “NASA’s 2015 optimal fleet” within the Vehicle Allocation Methodology (VAM) submitted to the General Services Administration in FY 2012. In 2015 NASA reported an overall fleet inventory reduction of 17%. Additionally, increased accuracy in data collection and reporting of fleet data via NASA’s Fleet Management Information System, allows the tracking and measurement of fuel-based performance metrics. In FY 2015, NASA exceeded EO 13423 “Petroleum Reduction” goal by more than a 40% decrease in petroleum use. NASA established EO 13693’s “GHG Emission per mile” 2014 benchmark and is on track to exceed the reduction milestone set for FY 2017. One challenge to the use of alternative-fueled vehicles is the lack of commercial infrastructure. In response, NASA considers increasing alternative fueling infrastructure within a Center’s campus, when such infrastructure allows for increased access to alternative fuel for NASA’s mostly campus type vehicle use.

Goal 5  |  Fleet Management
- Reduce petroleum consumption by 2% annually, compared to 2005; increase use of alternative fuels by 10% annually through FY 2015

Status as of September 30, 2015
- 62.2% Reduction in fleet petroleum use since 2005.
- 190% Increase in Use of Alternative Fuels in Alternative Fuel Vehicles (AFVs) and Flex-Fuel Vehicles (FFVs) compared to 2005, representing 37% of total fleet’s fuel use in FY 2015.
**Planned Actions**  NASA plans to continue its VURB process of reviewing and evaluating vehicle requirements for both existing and new requests. VURB reviews ensure right sizing of the NASA fleet, allowing NASA to identify end of life vehicle assets and consider opportunities for optimal AFV, FFV, low GHG and zero emission replacement selections.

**Success Examples**
- 9 Plug-In Electric vehicles
- 26 Hybrid Electric vehicles
- 247 Low-speed Electric vehicles
- 67% of vehicle fleet is Alternative Fuel capable
- 37% Alternative Fuel used
- 17% reduction of Agency Vehicle Inventory
- Currently exceeding 2017 milestone for per-mile GHG emissions reduction

**Getting a Charge out of Electric Vehicles**
Executive Order 13693 established new targets for acquiring electric vehicles for agency fleets. By FY 2020 20% of NASA’s new acquisitions (about 60 vehicles) should be electric; the goal for FY 2025 is 50% (about 150 vehicles.) The current inventory of electric fleet vehicles is 36. The Fixing America’s Surface Transportation Act (FAST) allows the NASA Administrator to allow privately owned vehicles (POV) to recharge their cars with NASA electricity. A working group is currently developing a NASA POV use policy and looking at possible methods for employees to reimburse the Agency for electricity used in POVs. Two Centers, Goddard Space Flight Center and Kennedy Space Center, have piloted the use of charging stations for POVs. The charging station pictured is located at Glenn Research Center’s (GRC) Mission Integration Center. Four plug-in hybrids were added to Glenn’s fleet, replacing four sedans. Feedback on the new vehicles has been very positive.

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**Goal 6 | Sustainable Acquisition**

- 95% of contracts meet federal mandates for acquiring products that are energy efficient, water efficient, biobased, environmentally preferable, non-ozone depleting, recycled content, or are non-toxic or less toxic alternatives

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<td>&gt;95% of applicable new contract actions meet federal mandates for acquiring products that are energy efficient, water efficient, biobased, environmentally preferable, non-ozone depleting, recycled content, or are non-toxic or less toxic alternatives, where these products meet performance requirements</td>
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**Summary**  NASA currently meets the requirement that 95% of applicable new contract actions comply with federal procurement mandates for green products and services. NASA’s contracting officers examine environmental sections completed by the intended acquisition end users; NASA Centers have the option to perform additional pre-solicitation and pre-award reviews.

**Planned Actions**  NASA expects to finalize the NPR 8530.1A for Sustainable Acquisition by the end of FY 2016. NASA will also continue to use other existing review mechanisms, the Procurement Management
Review (PMR) and Environmental and Energy Functional Review (EEFR) performed at each NASA Center. NASA plans to use the lessons learned from these reviews to inform development of specific training tailored to spur continual improvement at each Center. NASA will annually review 25% of the Master Specifications under its control and revise them to ensure that sustainable products are included as appropriate. This number of reviews will result in 100% of the total specifications under NASA’s control being reviewed for applicable sustainable products during a four-year cycle. NASA will also develop a Procurement Plan for Supply Chain GHG Reduction - as required by EO 13693 - and identify five new procurements that the Agency intends to award in FY 2017 that will require the awarded contractor to report GHG emissions and/or set GHG emission reduction targets.

Success Examples

- Completed EEFRs at five NASA facilities, which includes best practices for improving contract language relating to sustainable acquisition.
- Completed PMRs at three NASA facilities.

Biobased Purchasing at Kennedy Space Center

A George Washington University case study on bio-based purchasing noted that KSC has championed the use of biobased products, going beyond the requirements in EO 13693. Biobased products are composed in whole, or in significant part, of plants and other renewable agricultural, marine, and forestry materials. Biobased products include a wider array than might be expected - bioplastics, oils, lubricants, cleaners, degreasers, shampoos, soaps, inks, carpeting, disinfectants, electronic components cleaners and disposable cutlery. The study also noted that KSC leads the way, accounting for 39.5% of NASA’s biobased expenditures, but that Ames Research Center (ARC), Marshall Space Flight Center, and Johnson Space Center have also developed robust biobased programs.

In 2014 KSC spent almost $700K on designated biobased items across twenty-five product categories. Among those product categories, biobased cleaning products are used at both the KSC facilities and the Visitor Center complex; biobased hi-temp grease is used on the Vertical Assembly Building (VAB) doors; biobased coolant is used for metal working operations; Cargill’s biobased FR3 replaced transformer fluids; and 330 yards of biobased backed Signature Accord carpet was installed at the Visitor Complex. One specific example of successful replacement of a petroleum product with a biobased one involves the huge doors of the iconic Vertical Assembly Building. The doors, which slide over approximately one mile of rails, are lubricated once a year with about 140 pounds of grease, which is now a biobased product.

The case study cites many keys to success and lessons learned. Among them:

- On-site employees and contractors must work together to successfully make the switch to biobased products.
- Requisitioners need training to better understand how to purchase biobased products.
- New products need to be pilot-tested to ensure they will work for the specific application.
- Third-party, unbiased product performance reviews should be used to verify vendor claims.
Summary  NASA continued to exceed the EO diversion goals for construction and demolition debris and non-construction solid waste. Currently, the Agency tracks waste generation and disposition rates through NETS. Since recycling rates are the product of a complex interaction of multiple factors (e.g., maturity of the program, varying regional waste collection resources, type of commodities accepted, communication, and workforce engagement), these rates vary from Center to Center making a “one-size-fits-all” approach difficult. Successful implementation and continuous improvement of Center recycling programs depend on the Center’s flexibility to identify and to explore new waste stream opportunities as resources allow. These successes can then be modified to suit other Centers’ needs and requirements (shared as best practices). NASA uses several avenues to support and improve solid waste diversion efforts: 1) the Recycling and Sustainable Acquisition (RSA) Principal Center provides technical resources and program implementation support for waste prevention, recycling, and sustainable acquisition; 2) a web-based collaboration tool is used to share RSA work and to organize program activities and initiatives on both individual and team levels; 3) Environmental Management Systems are used to focus Center attention by employing a selection of priority aspects that are measured and evaluated on a continual basis; and 4) encouragement of the workforce is accomplished through various awards programs, notably the Agency’s Blue Marble Awards program and Presidential GreenGov Awards, which recognize individuals and teams with exemplary environmental performance, including waste diversion goals.

Planned Actions  NASA plans to improve its hydrofluorocarbon (HFC) usage data collection and expand the NETS dashboard to provide visual representation and trending analysis to identify opportunities for improvement. The Agency will continue to utilize other electronic means (e.g., paperless contracting and other internal web-based systems) to streamline processes and enhance communication. Also, via the Environmental and Energy Functional Reviews, NASA completes a representative sample contract review of each Center to reference the use of language related to pollution prevention and solid waste diversion. The Agency will also investigate opportunities to provide additional training to environmental and procurement professionals and provide other support, including sharing contractual examples of single stream recycling implementation.

Success Examples
- Continuation and maturation of single stream recycling programs at NASA Centers - several Centers have transitioned to single stream recycling, increasing employee participation and solid waste diversion opportunities.
- Volunteers at Johnson Space Center expanded the Coffee-to-Compost Program, increasing diversion by more than 5,000 pounds of coffee (18,632 lbs total) in addition to composting 73,080 pounds of kitchen prep food waste.
- Ames Research Center diverts clean tested soil from construction projects for use on the golf course and utilizes green waste as mulch.
- Johnson Space Center diverted 15,130 pounds of spent garnet from entering the waste stream by utilization in roadbed aggregate, which also reduced disposal costs.
- NASA hosted a two-day Workshop for an education and networking opportunity with the U.S. General Services Administration, the U.S. Environmental Protection Agency, the United Soybean Board, and other
government agencies. This meeting was in addition to quarterly web-based platforms hosted throughout the year to share best practices and lessons learned with regard to solid waste diversion.

- The Kennedy Space Center Chemistry Team received the 2015 GreenGov Presidential Award in the Green Innovation Category for using alternative cleaning solutions to eliminate ozone depleting substances and solvent use during precision cleaning.
- Freecycle@NASA is an ongoing opportunity for all Centers to replace supplies and furniture with used equipment from surplus. This program continues to eliminate items going to the landfill and reduces Center purchasing expenses.
- White Sands Test Facility has expanded waste diversion by recycling Kevlar security vests. This program is being evaluated by other centers to be incorporated into future waste diversion efforts.
- In March 2015, Stennis Space Center received the 2014 Environmental Hero Award as the Mississippi Recycler of the Year for State and Federal Government Agencies and Facilities.
- Sustainable Tracking Tool for Automated Recycling (STAR) is an online pickup request used at the Kennedy Space Center enabling the work force to report when recycling bins are three quarters full instead of having the recycling serviced continuously. Service routes are automatically generated.
- Centers continue to partner with local agencies to further NASA’s goals through hosting and participating in Earth Day, America Recycles Day, non-profit recycling programs, and educational outreach.

Stennis Space Center purchased composting equipment with revenues from metals recycling and repurposed a tractor during the excess property screening. SSC is assisting the State of Mississippi and breaking new ground by contributing to the first composting pilot program.

Clever and Cost-Saving Reuse at Johnson Space Center

Nathan Moore, who works at Johnson Space Center’s Habitability Design Center, made clever use of materials from the Redistribution and Utilization (R&U) Branch to develop a full-scale mock-up of the Orion exploration vehicle. The safety railings and the operator console frame were made from parts waiting to be excessed in a laydown yard; the flat-screened monitors and monitor stands came from the R&U warehouse. The aluminum lockers in the base of the mock-up were built on-site from reclaimed stock aluminum. The creative re-use approach saved NASA tens of thousands of dollars in material purchases and avoided disposal and recycling costs. The mock-up is being used for engineering-evaluation purposes but will eventually be used for astronaut training.
Summary  NASA awarded $114.3M investment value in Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESCs) through March 2016. This surpasses by $40.4M our President’s Performance Contracting Challenge pledge to award $73.9M by the end of 2016. Under Phase 2 of the Challenge, NASA awarded four projects including the Agency’s first combined heat and power (CHP) system. The CHP ESPC represents the largest investment value energy performance contract ever awarded by NASA.

Challenges  NASA field Centers encountered practices for interest rate premiums, financing termination fees, and contractor termination fees that differed from those previously experienced.

Planned Actions
- Implement and monitor energy performance contracts awarded in FY 2015 and 2016.
- Develop a Strategic Energy Investment Plan to help NASA senior leaders understand and prioritize energy efficiency, renewable electric energy, and clean energy opportunities across the Agency in support of NASA’s mission and GHG emission reductions.

Successes  NASA surpassed its 2016 target by awarding 55% more investment than pledged.
Summary  NASA continues to maintain a ‘green’ status for its Electronic Stewardship and Data Center goal, measured by: ensuring procurement preference for EPEAT-registered products; implementing policies to enable power management, duplex printing, and other energy-efficient features; employing environmentally sound practices with respect to the disposition of electronic products; procuring Energy Star and FEMP designated electronics; and implementing best management practices for data center operations. Strategic planning for data center consolidation is done at the Agency level. Data center consolidation and data center power monitoring is linked to the OMB’s 25 Point Plan for Shift to a Cloud First and Develop a Strategy for Shared Services, and previous Federal Data Center Consolidation Initiative (FDCCI) requirements for agencies to continue to principally reduce application, system, and database inventories to essential enterprise levels by increasing the use of virtualization to enable pooling of storage, network and compute resources, and dynamic allocation on-demand. The data center power monitoring initiative was largely abandoned due to budget reductions, but NASA has developed a standard methodology to calculate power usage effectiveness (PUE) at each of its 11 enterprise data centers. This methodology was developed because installing meters in all existing data centers is cost prohibitive. The remaining nine non-enterprise data centers’ PUE will be calculated using an industry PUE modeling tool per the Federal Information Technology Acquisition Reform Act (FITARA) date of September 30, 2018.

Challenges  Several challenges remain with respect to metering data centers and measuring and achieving average data center CPU utilization percentages by means of automated monitoring and power utilization effectiveness targets (>65% and 1.5, respectively). While NASA assessed its data centers in 2010 for meter placement, it has worked for several years to identify Federal Chief Information Officer (CIO) funding sources to install data center-specific meters; metering was typically done at the building level, not the room level. Other metering challenges remain, such as the complexity of getting readings from chilled water feeds and isolating the energy for chilled water associated with data center room and building. Measuring average CPU utilization requires agents conducting continuous measurements rather than snapshot measurements in all of its data centers except for its supercomputing facilities and large science data production facilities, which use a DCIM to monitor the CPUs for efficient computing operations. Other data centers will increase their utilization percentage as virtualization increases and more consolidation occurs. Virtualization will allow for monitoring of CPU unitization too. Once individual data center PUE’s are determined with the more cost effective NASA standard methodology, we can work on instituting best practices to lower their PUEs. Achieving the 1.5 PUE goal will be a challenge given the advanced age of several of the data center buildings and the cost of modifications to achieve substantial energy efficient improvements. As NASA increases the density in data centers by consolidation and has the opportunity to implement more energy savings best practices over time, PUE will improve.

Planned Actions  In the years that have passed since the consolidation effort was initiated, NASA has closed 50 of its 79 data centers. NASA will further shrink its data center inventory to approximately 22 by the end of FY2017. NASA has implemented appropriate life cycle improvements in many of the data centers that will remain permanently, including replacement of mechanical equipment, replacement of computer hardware,
the deployment of virtualization environments, size reductions and reconfigurations to improve hot/cold and airflow management. Those modifications are substantially complete and the savings gained from them realized. NASA has implemented an Agency-wide enterprise contract for the purchase and support of desktops, laptops, network printers, multifunction devices, and other computing devices. This enterprise contract contains specific energy efficient compliance clauses. Additionally, standardized configurations are implemented to ensure energy efficient settings are managed and monitored. NASA has established and expanded its End User Services Office organization to ensure efficiencies in desktop services functions, costs, and compliance with federal initiatives. NASA continues its normal refresh cycle for Agency Consolidated End-User Services enterprise contract procured office automation equipment ensuring 100% compliance with EPEAT standards. All NASA Enterprise IT Support and Services contracts contain clauses to ensure environmentally sound practices for disposition of all Agency excess or surplus equipment.

**Success Examples**

- Using new virtual technologies to reduce the need for physical servers.
- Replacing old servers with energy efficient models.
- Specific reduction in data center requirements as the Agency transitions to cloud services. During FY 2014 NASA transitioned its .nasa.gov web services infrastructure requirements to utilize a commercial cloud provider, and will complete a AWS FedGov service by the end of FY 2016.
- NASA has implemented a “Greening of IT” initiative that requires that when a computer system is refreshed, the existing monitor, docking, station, keyboard, and mouse are not replaced if they are still useable. This ensures peripheral equipment is used to the fullest extent of its lifecycle before disposal.

**Cleaning House!**

KSC recycled 6,672 obsolete computers and peripherals in FY 2015.
LaRC excessed 123 physical servers and added 121 virtual servers in the 4th quarter, FY 2015.
GRC recycled 15,540 pounds of electronics.
ARC recycled 99,091 pounds of e-waste.

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**Goal 10 | Climate Change Resilience**

Evaluate climate change risks to identify and manage the effects of climate change on the agency’s operations and mission in both the short and long term

**Status as of September 30, 2015**

- Provided NASA Centers with updated place-based climate data and information.
- Incorporated climate risk management and climate adaptation factors into sustainable facilities design program and master planning policies.
- Collaborated with federal and non-federal neighbors on climate risk management issues and climate adaptation efforts of mutual concern.

**Summary** Recognizing climate and extreme weather as risks to mission success, NASA leaders have made climate risks management a focus for safeguarding NASA’s assets against loss. Recognizing that needed changes are as much cultural as technical, NASA supports related research, seeks to strengthen related policies, and promotes robust participation in workshops and training. NASA’s Introduction to Sustainable Facilities training course, delivered twice in early 2016, now includes a module on Guiding Principle 6 – Assess and Consider Climate Change Risks.

NASA’s management approach to climate adaptation, described in its [NASA 2014 Climate Risk Management Plan](http://www.nasa.gov), has its foundation in risk management and is reflective of NPR 8000.4A – Agency Risk Management Procedural Requirements. NPR 8000.4 provides the framework for which offices are responsible for managing institutional risk – “Center Directors are responsible for management of institutional risks at their respective Centers. Headquarters Mission Support Offices are responsible for management of Agency-wide institutional risks” (NPR 8000.4A, section 1.2.1.e). In addition to its risk management process, NASA has been successful in identifying and updating policies and is committed to continuing to identify and revise policies as necessary to
manage climate risks and build resilience. NASA’s climate policy resides within NASA Procedural Directive (NPD) 8500, NASA Environmental Management. Climate considerations have been included in NASA’s Handbook: Master Planning Procedural Requirements and NPR 8800.15C, Real Estate Management Program. Additionally, NASA’s Program Managers and Project Managers are required by NPD 7500.1D, NASA Program and Project Life-Cycle Logistics Support Policy, to have processes, contract requirements and mechanisms to identify, and mitigate supply chain risks of disruption. Generally risks will be identified at the level of temporary or permanent loss or disruption of a supplier or disruption of transportation links between suppliers. There may be numerous reasons for such disruptions. Climate change may increase the likelihood or consequences of some causes of disruption. However, NASA’s risk management framework accommodates this without requiring explicit identification of climate change as being, or causing, new unique risks.

When conducting local adaptation processes at its field Centers, NASA recognizes and leverages external expertise from local government, academia, and private sector partners. It works to apply what it is learning not only within the Agency but with interested partners, including participation in two National Exercise Program (NEP) pilot projects in Houston-Galveston, Texas, and Hampton Roads, Virginia. NASA’s Climate Adaptation Science Investigators (CASI) team is a cadre of talented researchers doing relevant place-based climate science researchers partnered with NASA institutional managers. This team has been integral to NASA efforts to advancement, leveraging cutting-edge science, research, and computational modeling. NASA Earth Sciences Data Systems has a Data and Information Policy that includes making available all NASA-generated standard products, along with the source code for algorithm software, coefficients and ancillary data used in the generation of these products. This includes products used for monitoring climate relevant variables. This is ongoing and applies to the scientific community in general as well as other Federal agencies at national, regional and local scales. NASA’s open data policy is also referenced on page 17 of the 2014 NASA Science Plan.

**Planned Actions** NASA will continue to expand its focus on climate risks to more fully consider areas in which it sees particular opportunity, including energy, water, supply chain, transportation, and climate-resilient facilities design. NASA is initiating advanced climate risk management investigations in the areas of water scarcity and site hydrology concerning facilities and buildings, especially as they relate to NASA’s operations and mission. NASA will also be providing its field Centers with a U.S. climate information “atlas” for awareness and screening to better manage NASA’s climate risks in energy, water supply, and flood risk. NASA will continue to collaborate with federal and local partners in communities in which it operates, leveraging the expertise resident in nearby NASA Centers. NASA will continue to host the Interagency Forum on Climate Change Impacts & Adaptation, which NASA co-chairs, to advance climate literacy and technical expertise in numerous federal agencies. NASA’s Introduction to Sustainable Facilities training course, which includes a module on Guiding Principle 6 – Assess and Consider Climate Change Risks, should be delivered twice in FY 2017. In addition, NASA’s Construction of Facilities Management Training Class is in the process of being revised to incorporate resiliency, including climate change risks.

NASA scientists will continue participating in an interagency working group to make Federal climate data available through the climate.data.gov portal, as part of the Climate Data Initiative activity overseen by the Climate Data and Tools Working Group, chaired by Office of Science and Technology Policy (OSTP) and co-chaired by NASA. NASA is also an active participant in the U.S. Global Change Research Program’s (USGCRP’s) National Climate Assessment (NCA) activities. Quadrennial NCA reports integrate and analyze the effects of global change and project trends in the future. NASA supports assessment-relevant research within our internal (NASA Center) and external research communities, and HQ personnel participate in planning quadrennial reports and other sustained assessment activities. Through these efforts, NASA makes its climate
data discoverable and available to the assessment community via NASA data portals and through the USGCRP’s Global Change Information System.

**Langley Research Center Adapting Itself and Neighbors**

In addition to LaRC, the Hampton Roads region in Virginia is home to the nation’s third largest seaport, the world’s largest naval base, and the nation’s second largest military presence. The region faces the fastest rates of sea level rise on the East Coast, much of which is caused by land subsidence. LaRC research is contributing to developing scientific and technological solutions to better understand and respond to sea level rise. For example, LaRC has installed new sea level gauges and subsidence monitoring piers to provide regional measurements previously unavailable in the area. LaRC scientists are using the web-based Flood Impact Analysis Tool to analyze flood impacts and providing a real-time risk assessment of Center facilities; the tool has been replicated for use by Langley Air Force Base, Fort Monroe, and the City of Poquoson. In addition, the Center is providing geographic information system (GIS)-based flood management tools to the Department of Defense (DoD), local government, and other relevant Hampton Roads groups for planning purposes. Furthermore, LaRC is contributing to the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Planning Pilot Project, which includes planning organizations of all levels of government, along with significant academic, non-profit, and business organization participation.

In early May 2016, LaRC dedicated its new Computational Research Center to Katharine Johnson, a Presidential Medal of Freedom recipient who worked at LaRC from 1953 – 1986. She was hired as part of a pool of women who performed mathematical equations and calculations by hand for engineers. She performed the computations, by hand, of the launch window and trajectory for Alan Shepard’s maiden space voyage aboard Freedom 7 in 1961. She also verified, by hand, the calculations made by the first computers for John Glenn’s orbit around the Earth in 1962. The new building was elevated above the 500-year floodplain (finished floor elevation of 15.5 ft) in order to adapt to expected sea level rise.

**PROGRESS ON ADMINISTRATION PRIORITIES**

Discuss how your agency will meet progress milestones and key strategies related to the following areas:

**President’s Performance Contracting Challenge**

NASA achieved its 2016 target for the President’s Performance Contracting Challenge. NASA awarded $114.3M investment value in Energy Savings Performance Contracts and Utility Energy Services Contracts) through March 2016. This surpasses by $40.4M our President’s Performance Contracting Challenge pledge to award $73.9M by the end of 2016. Under Phase 2 of the Challenge, NASA awarded four projects including the Agency’s first CHP system. The CHP ESPC represents the largest investment value energy performance contract ever awarded by NASA.

In response to EO 13693’s challenging energy goals, NASA initiated an effort to develop a Strategic Energy Investment Plan with Department of Energy and industry support. The Plan will provide information to help
NASA senior leaders understand and prioritize energy efficiency, renewable electric energy, and clean energy opportunities across the Agency in support of NASA’s mission and GHG emission reductions. Because the planning will occur during FY 2016 and FY 2017, NASA is refraining from setting energy performance contract investment value targets for FY 2017 and FY 2018 in this 2016 SSPP.

**Electric and Zero Emission Vehicles**

NASA has already integrated 36 Zero Emission vehicles (EVs) into its Agency Fleet. As an early adopter of EVs, NASA took advantage of GSA’s 2013 EV pilot program to receive five EVs and in 2014 grew the fleet by an additional 15 EVs. In 2015, NASA acquired 10 additional EVs, and thus far in FY 2016, has acquired another six EVs. NASA is actively seeking opportunities to acquire additional EVs through a GSA contract signed with Ford. NASA sees itself as an early adopter of electric vehicles and plans to assess mission requirements during end-of-life replacement to pursue the highest level of electric vehicle acquisitions as possible.

Additionally, NASA is developing guidance on use of NASA recharging access points for use by Privately Owned EVs. NASA’s working group hopes to have guidance out to the NASA Centers by end of FY 2016. This guidance will phase in use of existing infrastructure and address how future infrastructure will impact POV use of the infrastructure, while still primarily supporting NASA’s fleet electric vehicles. NASA’s milestone for 2020 is 60 EVs within the fleet and the 2025 target is 150 EVs.

**Climate Preparedness and Resilience**

As noted in the [NASA 2014 Climate Risk Management Plan](#), NASA recognized as early as 2005 that ‘regional climate variability’ could pose a risk to its operations and missions and identified it as a risk within NASA’s risk management framework. Recent progress specific includes:

- Providing NASA Centers with updated place-based climate data and information.
- Incorporating climate risk management and climate adaptation factors into sustainable facilities design program and master planning policies.
- Collaborating with federal and non-federal neighbors on climate risk management issues and climate adaptation efforts of mutual concern.

NASA will continue to expand its focus on climate risks to more fully consider areas in which it sees particular opportunity, including energy, water, supply chain, transportation, and climate-resilient facilities design. NASA is initiating advanced climate risk management investigations in the areas of water scarcity and site hydrology concerning facilities and buildings; especially as they relate to NASA’s operations and mission. NASA will also be providing NASA Centers with a US climate information “atlas” for awareness and screening to better manage NASA’s climate risks in areas including: energy, water supply, and flood risk. NASA will continue to collaborate with federal and local partners in communities in which it operates, including participation in two National Exercise Program (NEP) pilot projects in Houston-Galveston, Texas, and Hampton Roads, Virginia.

NASA scientists will continue their climate research and participate in efforts of the U.S. Global Change Research Program (USGCRP) and other organizations focused on climate science, resilience, and adaptation. CASI scientists will continue to provide guidance and expertise to institutional managers charged with managing climate risks.
**Executive Order 13693 | Planning for Federal Sustainability in the Next Decade**

### NEW TARGETS

<table>
<thead>
<tr>
<th>Goal</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Goal 1** | **Greenhouse Gases**  
- Reduce direct GHG emissions (onsite or offshore) by 47% and reduce indirect GHG emissions (e.g., commuting, travel) by 32% by FY 2025, compared to 2008 |
| **Goal 2** | **Sustainable Buildings**  
- Reduce energy use/GSF by 2.5% annually through FY 2025, compared to FY 2015  
- 1% of the agency's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY 2025  
- At least 23% of buildings, or 30% of Gross Square Footage, will meet Guiding Principles by FY 2025 |
| **Goal 3** | **Clean & Renewable Energy**  
- At least 10% of agency's total electricity consumption is from renewable energy sources, for FY 2016 and FY 2017  
- At least 10% of agency's total electricity consumption and thermal energy is from clean energy sources, for FY 2016 and FY 2017 |
| **Goal 4** | **Water Use**  
- Reduce potable intensity (gal/sq ft) by 2% annually through FY 2025, compared to 2007; reduce use for industrial, landscaping, and agricultural by 2% annually through FY 2025, compared to 2010; install appropriate green infrastructure to improve storm water and wastewater management |
| **Goal 5** | **Fleet Management**  
- Reduce per-mile GHG emissions by 4% by 2017, 15% by 2021, 30% by 2025, compared to 2014 |
| **Goal 6** | **Sustainable Acquisition**  
- Ensure that environmental performance and sustainability factors are considered to the maximum extent practicable for all applicable procurements  
- Award 1,100 contracts with Biopreferred and biobased criteria, with estimated value of $1,000,000, to be delivered in FY 2016 |
| **Goal 7** | **Pollution Prevention & Waste Reduction**  
- Divert 50% of solid waste (excluding construction and demolition debris); divert 50% of construction and demolition debris  
- Reduce acquisition, use, and disposal of toxic and hazardous materials, particularly when helpful in meeting GHG reduction goals |
| **Goal 8** | **Energy Performance Contracts**  
- Award $73.9M investment value in Energy Savings Performance Contracts and Utility Energy Services Contracts by the end of 2016 |
| **Goal 9** | **Electronic Stewardship & Data Centers**  
- Ensure 95% of monitors, PCs, and laptops acquired meet environmentally sustainable electronics criteria (EPEAT registered)  
- Ensure 100% of computers, laptops, and monitors have power management features enabled; follow environmentally sound methods for disposal |
| **Goal 10** | **Climate Change Resilience**  
- Evaluate climate change risks to identify and manage the effects of climate change on the agency’s operations and mission in both the short and long term |

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**Looking Forward.** This chart represents a snapshot of our targets going forward.
## AGENCY SIZE & SCOPE

### Table 1: Agency Size & Scope

<table>
<thead>
<tr>
<th>Agency Size and Scope</th>
<th>FY 2014</th>
<th>FY 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Employees as Reported in the President's Budget</td>
<td>17,715</td>
<td>17,302¹</td>
</tr>
<tr>
<td>Total Acres of Land Managed</td>
<td>329,462</td>
<td>326,322</td>
</tr>
<tr>
<td>Total Number of Buildings Owned*</td>
<td>2,359</td>
<td>2,719²</td>
</tr>
<tr>
<td>Total Number of Buildings Leased (GSA and Non-GSA Lease)*</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Total Building Gross Square Feet (GSF)*</td>
<td>46,515,922</td>
<td>46,722,414³</td>
</tr>
<tr>
<td>Operates in Number of Locations Throughout U.S.*</td>
<td>47</td>
<td>57⁴</td>
</tr>
<tr>
<td>Operates in Number of Locations Outside of U.S.*</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Total Number of Fleet Vehicles Owned</td>
<td>871</td>
<td>797</td>
</tr>
<tr>
<td>Total Number of Fleet Vehicles Leased</td>
<td>2,132</td>
<td>1,989</td>
</tr>
<tr>
<td>Total Number of Exempted-Fleet Vehicles (Tactical, Law Enforcement, Emergency, Etc.)</td>
<td>249</td>
<td>228</td>
</tr>
<tr>
<td>Total Amount Contracts Awarded as Reported in Federal Procurement Data System (FPDS) ($Millions)</td>
<td>1,493.0</td>
<td>1,190.8</td>
</tr>
</tbody>
</table>

* Unless otherwise noted, increases are a result of database reconciliation and corrections, driven partially by NASA’s policy change in FY 2014 to ensure all of its buildings are documented in its database, particularly those with an acquisition cost of less than $5,000.

Note 1: Civil Service Full Time Equivalent (includes 194 for Office of the Inspector General).

Note 2: Five new buildings were constructed in FY 2015 and an additional one was significantly modified.

Note 3: The Columbia Scientific Balloon Facility (58,960 sf) in Palestine, Texas, was transferred from the National Science Foundation to NASA.

Note 4: The transfer of the Columbia Scientific Balloon Facility increased the number of locations throughout US by one.
AGENCY PROGRESS & STRATEGIES TO MEET FEDERAL SUSTAINABILITY GOALS

This section provides an overview of NASA’s progress through FY 2015 on sustainability goals contained in Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, and NASA’s strategies to meet the new and updated goals established by Executive Order 13693, Planning for Federal Sustainability in the Next Decade.

Each agency should indicate four to seven “priority strategies” per goal from the Council on Environmental Quality / Office of Management and Budget (CEQ/OMB) SSPP Template that are appropriate for the agency to implement in FY 2017. Where noted, NASA has modified or added its own strategies.

Goal 1: Greenhouse Gas (GHG) Reduction

Scope 1 & 2 GHG Reduction Goal

EO 13693 requires each agency to establish a Scope 1 & 2 GHG emissions reduction target to be achieved by FY 2025 compared to a 2008 baseline. NASA’s 2025 Scope 1 & 2 GHG reduction target is 47%.

Chart: Progress Toward Scope 1 & 2 GHG Reduction Goal
## Scope 1 & 2 GHG Reduction Strategies

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted.*

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Priority for FY 2017</th>
<th>Strategy Narrative</th>
<th>Targets and Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the Federal Energy Management Program (FEMP) GHG emission report to identify/target high emission categories and implement specific actions to address high emission areas identified.</td>
<td>Yes</td>
<td>NASA will evaluate the FEMP GHG emission report annually to determine the top 3 emission categories and investigate alternatives for implementation. NASA will also continue to implement energy efficiency and alternative energy projects.</td>
<td>1) Complete updated evaluation of FEMP GHG emission report and alternatives in 6 months, based on latest FY 2015 GHG workbook submission. 2) Over the next 18 months continue to explore options concerning HFCs and newly reportable nitrogen trifluoride, while working towards strategic partnerships with other Agencies to form better strategies for reducing use of these GHG chemicals.</td>
</tr>
<tr>
<td>Identify and support management practices or training programs that encourage employee engagement in addressing GHG reduction.</td>
<td>Yes</td>
<td>Finalize the multi-purpose core training GHG module and discipline-specific guidance; make available electronically through either the NASA GHG website or NASA Environmental Tracking System (NETS).</td>
<td>1) Within 12 months, develop the core training GHG module and guidance for: a) NASA management staff, b) energy managers, c) sustainability coordinators, d) NEPA coordinators, e) transportation planners 2) Within 18 months, post training materials online on either NASA’s GHG website or NETS.</td>
</tr>
<tr>
<td>Determine unsuccessful programs or measures to be discontinued to better allocate agency resources.</td>
<td>No</td>
<td>Already implemented new statistical approach, a “rolling average,” to allow long-term reduction planning despite large annual fluctuations in fugitive GHG emissions.</td>
<td>NA</td>
</tr>
<tr>
<td>Given agency performance to date, determine whether current agency GHG target should be revised to a more aggressive/ambitious target.</td>
<td>No</td>
<td>No longer applicable following release of EO 13693 and establishment of new reduction target.</td>
<td>NA</td>
</tr>
<tr>
<td>Employ operations and management (O&amp;M) best practices for emission generating and energy consuming equipment.</td>
<td>Yes</td>
<td>Achieving reduction targets will require NASA Centers to aggressively implement best practices through setting Center targets using parametric technology spin-in approach (technology knowledge curves and technology learning curves).</td>
<td>1) Over the next 12 months, work with NASA Center energy and environmental staff to finish translating Agency-wide targets to achievable Center-level equivalents using the parametric technology spin-in approach. 2) Within 18 months, link this approach with lessons learned from the Department of Energy (DOE) Research, Development, and Deployment (RD&amp;D) programs.</td>
</tr>
<tr>
<td>Identify additional sources of data or analysis with the potential to support GHG reduction goals.</td>
<td>Yes</td>
<td>Finish exploring DOE RD&amp;D programs to reduce lag time to commercial technology adaptation: 1) Quadrennial Technology Review (QTR) 2) DOE Strategic Plan 3) Energy Department’s Advanced Research Projects Agency-Energy (ARPA-E)</td>
<td>1) Finish review of DOE QTR, Strategic Plan, and ARPA-E projects within 6 months. 2) Vet any new data or methodologies with FEMP within 12 months. 3) Implement selected top priority strategies internally within 18 months.</td>
</tr>
</tbody>
</table>
Scope 3 GHG Reduction Goal

EO 13693 requires each agency to establish a Scope 3 GHG emission reduction target to be achieved by FY 2025 compared to a 2008 baseline. NASA’s 2025 Scope 3 GHG reduction target is 32%.

Chart: Progress Toward Scope 3 GHG Reduction Goal
### Scope 3 GHG Reduction Strategies

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted.*

<table>
<thead>
<tr>
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<th>Priority for FY 2017</th>
<th>Strategy Narrative</th>
<th>Targets and Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce employee business ground travel.</td>
<td>Yes</td>
<td>1) NASA will continue to implement reductions through telework and remote training events and meetings. 2) Will continue to look for alternative metrics for measuring success other than reduced emissions through Workplace Strategies and other working groups.</td>
<td>Over the next 18 months 1) hold remote training events and meeting and 2) identify and implement at least one new success metric related specifically to business ground travel through Workplace Strategies working group or additional information sources, as available.</td>
</tr>
<tr>
<td>Reduce employee business air travel.</td>
<td>Yes</td>
<td>1) NASA will continue to implement reductions through telework and remote training events and meetings. 2) Will continue to look for alternative metrics for measuring success other than reduced emissions through Workplace Strategies and other working groups.</td>
<td>Over the next 18 months 1) hold remote training events and meeting and 2) identify and implement at least one new success metric related specifically to business ground travel through Workplace Strategies working group or additional information sources, as available.</td>
</tr>
<tr>
<td>Develop and deploy an employee commuter emissions reduction plan.</td>
<td>Yes</td>
<td>NASA Multimodal Access Plan (MAP) incorporates this strategy.</td>
<td>See MAP appendix for details.</td>
</tr>
<tr>
<td>Use an employee commuting survey to identify opportunities and strategies for reducing commuter emissions.</td>
<td>Yes</td>
<td>1) Update the FY 2016 NASA commuter survey questions to facilitate more detailed analysis at the Center level, such as collecting information regarding commuting incentives and strategies, and limitations present in specific regions. 2) Continue to determine potential Center level opportunities and strategies in keeping with individual Center needs or limitations.</td>
<td>1) Within 6 months, brainstorm new questions for the FY 2016 Agency-wide commuter survey to collect data in support of detailed Center-level analysis and improvement of the MAP. 1) Within 12 months, perform a detailed review of the FY 2016 survey dataset, including producing statistical data. 3) Over the next 18 months, use the FY 2016 commuter survey data to engage NASA HR and other cross-functional departments more thoroughly and directly improve strategies.</td>
</tr>
<tr>
<td>Increase &amp; track number of employees eligible for telework and/or the total number of days teleworked.</td>
<td>No</td>
<td>NASA MAP already contains the required elements of this strategy.</td>
<td>NA</td>
</tr>
<tr>
<td>Develop and implement a program to support alternative/zero emissions commuting methods and provide necessary infrastructure.</td>
<td>No</td>
<td>NASA MAP already contains the required elements of this strategy.</td>
<td>NA</td>
</tr>
<tr>
<td>Establish policies and programs to facilitate workplace charging for employee electric vehicles.</td>
<td>No</td>
<td>NASA MAP already contains the required elements of this strategy.</td>
<td>NA</td>
</tr>
<tr>
<td>Strategy</td>
<td>Priority for FY 2017</td>
<td>Strategy Narrative</td>
<td>Targets and Metrics</td>
</tr>
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<td>-------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Include requirements for building lessor disclosure of carbon emission</td>
<td>Yes</td>
<td>NASA will complete an ongoing internal assessment of fully serviced leased spaces,</td>
<td>1) Complete leased building assessment process and establish data collection procedures within 6 months.</td>
</tr>
<tr>
<td>or energy consumption data and report Scope 3 GHG emissions for leases</td>
<td></td>
<td>begin collecting data, and report as required in the FY 2016 GHG workbook.</td>
<td>2) Collect and report all data in the FY16 GHG workbook prior to the 31 Jan 2017 due date.</td>
</tr>
<tr>
<td>over 10,000 rentable square feet.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Goal 2: Sustainable Buildings**

**Building Energy Conservation Goal**

The Energy Independence and Security Act of 2007 (EISA) requires each agency to reduce energy intensity 30% by FY 2015 as compared to FY 2003 baseline. Section 3(a) of EO 13693 requires agencies to promote building energy conservation, efficiency, and management and reduce building energy intensity by 2.5% annually through the end of FY 2025, relative to a FY 2015 baseline and taking into account agency progress to date, except where revised pursuant to Section 9(f) of EO 13693.

**Chart: Progress Toward Facility Energy Intensity Reduction Goal**

![Graph showing energy intensity reduction progress from 2003 to 2025 with targets marked]
### Building Energy Conservation Strategies

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted.*

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Priority for FY 2017</th>
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<th>Targets and Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make energy efficiency investments in agency buildings.</td>
<td>Yes</td>
<td>1) All new construction projects are designed with energy goals of meeting EO13693 and the Guiding Principles. 2) Centers are encouraged to submit energy projects annually, providing the greatest energy usage reduction. Centers’ submitted projects are reviewed and compete for limited funding with other submitted energy projects.</td>
<td>NPR 8820.2, Facility Project Requirements, includes energy efficiency requirements for new construction and large facility rehabilitation projects. Execute FY 2017 appropriations funding for energy projects submitted within President’s Budget.</td>
</tr>
<tr>
<td>Use remote building energy performance assessment auditing technology</td>
<td>No</td>
<td>NASA is currently investigating available remote auditing technologies. NASA Centers can use these new technologies if they decide that these new methods are beneficial in meeting comprehensive building evaluation requirements.</td>
<td>NA</td>
</tr>
<tr>
<td>Participate in demand management programs.</td>
<td>Yes</td>
<td>NASA Centers are taking advantage of demand management programs offered by local utility providers. These programs include peak shaving activities through generation from on-site generators and load reduction activities.</td>
<td>These demand management programs had historically been activated by requests from utility providers during high usage periods. NASA HQ reviews Center demand management programs during Environmental and Energy Functional Management Reviews (triennially).</td>
</tr>
<tr>
<td>Incorporate Green Button data access system into reporting, data analytics, and automation processes.</td>
<td>No</td>
<td>NASA Centers are aware of Green Button data access system and will work with utility when system is available</td>
<td>NA</td>
</tr>
<tr>
<td>Redesign interior space to reduce energy use through daylighting, space optimization, and sensors and control systems.</td>
<td>Yes</td>
<td>NASA incorporates these sustainable practices in new construction (LEED® Silver) and also major building renovations.</td>
<td>NASA NPR 8820 requires new construction to be at least LEED® Silver.</td>
</tr>
<tr>
<td>Identify opportunities to transition test-bed technologies to achieve energy reduction goals.</td>
<td>No</td>
<td>Strategy is imbedded in Agency routine operations. At least one Center, Ames Research Center, uses appropriate Center staff and space exploration technologies to demonstrate possible near future energy reduction goal methods.</td>
<td>NA</td>
</tr>
<tr>
<td>Follow city energy performance benchmarking and reporting requirements.</td>
<td>No</td>
<td>NASA is following federal energy performance benchmarking using Energy Star Portfolio Manager and annual federal reporting requirements.</td>
<td>NA</td>
</tr>
<tr>
<td>Install and monitor energy meters and sub-meters.</td>
<td>Yes</td>
<td>NASA is installing electric, natural gas, and steam metering at building level to measure and monitor energy usage.</td>
<td>NASA Centers report annually current and planned metering status for electric, natural gas, and steam metering in the NASA Environmental Tracking System (NETS).</td>
</tr>
<tr>
<td>Strategy</td>
<td>Priority for FY 2017</td>
<td>Strategy Narrative</td>
<td>Targets and Metrics</td>
</tr>
<tr>
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<td>---------------------</td>
</tr>
<tr>
<td>Collect and utilize building and facility energy use data to improve building energy management and performance.</td>
<td>Yes</td>
<td>NASA Centers are using Energy Management Control Systems (EMCS) for monitoring energy use and building optimization. Centers are also reporting energy use into NETS on quarterly basis for trending usage and anomaly reporting.</td>
<td>Centers are using monitoring data from their EMCS on daily basis to analyze and manage building energy use. Quarterly energy data reported into NETS is being used for trending and identification of anomalies compared to same time frame of previous year.</td>
</tr>
<tr>
<td>Ensure that monthly performance data is entered into the EPA ENERGY STAR Portfolio Manager.</td>
<td>Yes</td>
<td>NASA Centers are required to enter monthly utility data into Energy Star Portfolio Manager.</td>
<td>Data from Portfolio Manager is reported into DOE Compliance Tracking System (CTS).</td>
</tr>
</tbody>
</table>

**Building Efficiency, Performance, and Management Goal**

Section 3(h) of EO 13693 states that agencies will improve building efficiency, performance, and management and requires that agencies identify a percentage of the agency's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY 2025 and implementing actions that will allow those buildings to meet that target. NASA’s 2025 target is 1%. Beginning in FY 2017, which is three years before the Federal EO requirement, NASA will require NASA Centers to use the NREL-partnered and developed NASA Net Zero Energy Buildings Roadmap guide for all new construction design.

**Guiding Principles for Sustainable Federal Buildings**

Section 3(h) of EO 13693 also states that agencies will identify a percentage, by number or total GSF, of existing buildings above 5,000 GSF that will comply with the Guiding Principles for Sustainable Federal Buildings (Guiding Principles) by FY 2025.

NASA’s FY 2025 target is 23% by number of buildings or 30% by total GSF.

**Chart: Percent of Buildings Meeting the Guiding Principles**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>FY 2015 Goal</td>
<td>15%</td>
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<td></td>
<td></td>
<td>19.8%</td>
</tr>
<tr>
<td>Percent Compliance</td>
<td>0%</td>
<td>1.4%</td>
<td>1.2%</td>
<td>4.4%</td>
<td>5.0%</td>
<td>6.7%</td>
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<tr>
<td>Buildings</td>
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<tr>
<td>Percent Compliance</td>
<td>0%</td>
<td>11.8%</td>
<td>12.8%</td>
<td>14.3%</td>
<td>14.3%</td>
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<tr>
<td>Buildings</td>
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<tr>
<td>Percent Compliance</td>
<td>0%</td>
<td>12.6%</td>
<td>12.8%</td>
<td>10.7%</td>
<td>15.3%</td>
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<td>Buildings</td>
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<td>Percent Compliance</td>
<td>0%</td>
<td>6.7%</td>
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<td>GSF</td>
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</table>
# Sustainable Buildings Strategies

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted.*

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Priority for FY 2017</th>
<th>Strategy Narrative</th>
<th>Targets and Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include climate resilient design and management into the operation, repair, and renovation of existing agency buildings and the design of new buildings.</td>
<td>No</td>
<td>NASA currently considers climate resiliency during major facilities projects. NASA is focusing on other strategies with higher priority for Goal 2.</td>
<td>NA</td>
</tr>
<tr>
<td>In planning new facilities or leases, include cost-effective strategies to optimize sustainable space utilization and consideration of existing community transportation planning and infrastructure, including access to public transit.</td>
<td>No</td>
<td>NASA currently emphasizes space utilization and available public transit during major facilities projects. NASA determined other strategies as higher priority for Goal 2.</td>
<td>NA</td>
</tr>
<tr>
<td>Ensure all new construction of Federal buildings greater than 5,000 GSF that enters the planning process be designed to achieve energy net-zero and, where feasible, water or waste net-zero by FY 2030.</td>
<td>Yes</td>
<td>Pursue NASA's Net Zero Energy Buildings roadmap developed in 2014 as a strategic approach to planning, design, construction and operation of Net Zero Energy buildings.</td>
<td>For discrete projects that are funded for Facility Planning and Design in FY16 and are greater than $10M in value, at least one new tactic identified in NASA's roadmap will be piloted.</td>
</tr>
<tr>
<td>Include criteria for energy efficiency as a performance specification or source selection evaluation factor in all new agency lease solicitations over 10,000 rentable square feet.</td>
<td>Yes</td>
<td>In keeping with the EO, NASA will incorporate criteria for energy efficiency in its performance specifications or selection criteria for leased spaces over 10,000 SF.</td>
<td>NASA Policy will be developed to require all new leases to include these criteria and is expected to be completed in FY 2017.</td>
</tr>
<tr>
<td>Incorporate green building specifications into all new construction, modernization, and major renovation projects.</td>
<td>Yes</td>
<td>NASA continues to apply Agency sustainable building policies for all new construction and major renovation projects, with updated policy issued in 2014. Sustainable Facilities training course continues to be refined and updated after each course offering to meet emerging sustainable practices and strategies.</td>
<td>Develop verification process during design phase to ensure appropriate projects include LEED® objectives. Sustainable Facilities training course will be offered once by June 2017.</td>
</tr>
<tr>
<td>Implement space utilization and optimization practices and policies.</td>
<td>Yes</td>
<td>NASA will continue to work on space utilization policies and include leased space.</td>
<td>Establishing space utilization and daylighting design standards to be applied to new administrative and office space. The policy is in review and is associated with the revised NASA Facilities Design Guide. Expected release date is FY 2017.</td>
</tr>
<tr>
<td>Implement programs on occupant health and well-being in accordance with the Guiding Principles.</td>
<td>No</td>
<td>NASA currently considers climate resiliency during major facilities projects. NASA is focusing on other strategies with higher priority for Goal 2.</td>
<td>NA</td>
</tr>
</tbody>
</table>
Goal 3: Clean & Renewable Energy

Clean Energy Goal
EO 13693 Section 3(b) requires that, at a minimum, the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY 2016-17; 13% in FY 2018-19; 16% in FY 2020-21; 20% in FY 2022-23; and 25% by FY 2025.

Renewable Electric Energy Goal
EO 13693 Section 3(c) requires that renewable energy account for not less than 10% of total electric energy consumed by an agency in FY 2016-17; 15% in FY 2018-19; 20% in FY 2020-21; 25% in FY 2022-23; and 30% by 2025.

Chart: Use of Renewable Energy as a Percentage of Total Electric Energy

Clean and Renewable Energy Strategies
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<tbody>
<tr>
<td>Install agency-funded renewable on-site and retain corresponding renewable energy certificates (RECs).</td>
<td>Yes</td>
<td>NASA is performing a self-assessment at the Center level on how to achieve energy goals for 2025. The Agency is also performing an Energy Investment Assessment to evaluate renewable and clean energy resources for the Agency in 2016. The Agency is planning to include at least one renewable energy project in annual budget requests. Centers are encouraged to include renewable installations with new construction and major building rehabilitation projects.</td>
<td>NASA has awarded contracts to install over 3 MW of solar PV at two facilities, which are expected to be completed late 2016 or early 2017. NASA also is installing a 285KW roof top system to be online in 2016. Centers are designing three clean or renewable energy systems to prepare for projects programmed for FY 2017 and FY 2018.</td>
</tr>
<tr>
<td>Contract for the purchase of energy that includes installation of renewable energy on or off-site and retain RECs or obtain replacement RECs.</td>
<td>Yes</td>
<td>NASA is pursuing several strategies to meet the Clean Renewable energy goal, including power purchase agreements.</td>
<td>NASA is pursuing a PPA option for a 1 MW roof top project.</td>
</tr>
<tr>
<td>Purchase electricity and corresponding RECs or obtain equal value replacement RECs.</td>
<td>Yes</td>
<td>NASA Centers are responsible for procuring RECs and renewable energy directly to meet renewable energy requirements.</td>
<td>Some NASA Centers are purchasing renewable energy directly from utilities through their contracts with the provider. These contracts are negotiated for several years, and federal renewable energy requirements are part of the contract language.</td>
</tr>
<tr>
<td>Purchase RECs to supplement installations and purchases of renewable energy, when needed to achieve renewable goals.</td>
<td>Yes</td>
<td>NASA is implementing several strategies to meet the renewable energy goal. The most cost effective path to satisfy the increasing requirements is the purchase of RECs. More than 75% of NASA's renewable energy is from REC purchases.</td>
<td>NASA HQ evaluates renewable energy performance during Q2 of FY to ensure Agency meets EO 13693 goals. With current budget constraints and increasing prices, new increased goals, buying RECs will be more challenging and may result in not meeting goal in future.</td>
</tr>
<tr>
<td>Install on-site thermal renewable energy and retain corresponding renewable attributes or obtain equal value replacement RECs.</td>
<td>Yes</td>
<td>NASA is using thermal renewable energy in the form of methane from a landfill and steam generated from municipal trash.</td>
<td>Problems due to pressure issues in the delivery system have been resolved and delivery of methane from landfill has resumed. The trash-to-steam plant has been out of production due to its aging distribution system. NASA has been repairing steam pipes and the system will be again operational in 2016.</td>
</tr>
<tr>
<td>Install on-site combined heat and power processes.</td>
<td>Yes</td>
<td>NASA actively pursues opportunities at Centers for CHP and works with the EPA CHP Partnership to perform initial feasibility studies to evaluate savings and life cycle costs. During the Environmental and Energy Functional Reviews, NASA HQ is working with possible candidates to perform preliminary surveys for possible projects.</td>
<td>NASA awarded an ESPC to install over 12MW of CHP at a NASA Center. The project is under construction and expected to be online in 2017. NASA also performed a level 2 study at another Center, and the report identified several options. The study is currently under review; however, high implementation costs may prevent NASA from following through on this project.</td>
</tr>
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<tr>
<td>Identify opportunities to install on-site fuel cell energy systems.</td>
<td>No</td>
<td>NASA has installed fuel cell energy systems at Centers, and will continue to evaluate future installations.</td>
<td>NA</td>
</tr>
<tr>
<td>Identify opportunities to utilize energy that includes the active capture and storage of carbon dioxide emissions associated with energy generation.</td>
<td>No</td>
<td>NASA will evaluate future opportunities to utilize this technology where cost effective.</td>
<td>NA</td>
</tr>
<tr>
<td>Identify and analyze opportunities to install or contract for energy installed on current or formerly contaminated lands, landfills, and mine sites.</td>
<td>Yes</td>
<td>NASA evaluates current or formerly contaminated land for clean and renewable energy installations to support clean up and restoration efforts and reduce energy costs due to these long-term efforts.</td>
<td>NASA awarded a contract to install over 1MW photovoltaic system on land that is subject to groundwater remediation. The project is to be constructed in 2016 to be online early 2017.</td>
</tr>
<tr>
<td>Identify opportunities to utilize energy from small modular nuclear reactor technologies.</td>
<td>No</td>
<td>NASA plans do not include generation from SMNR technologies, however will consider use of energy from such technology if available and cost effective.</td>
<td>NA</td>
</tr>
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**Goal 4: Water Use Efficiency & Management**

**Potable Water Consumption Intensity Goal**

EO 13693 Section 3(f) states that agencies must improve water use efficiency and management, including storm water management, and requires agencies to reduce potable water consumption intensity, measured in gallons per square foot, by 2% annually through FY 2025 relative to an FY 2007 baseline. A 36% reduction is required by FY 2025.

**Industrial, Landscaping and Agricultural (ILA) Water Goal**

EO 13693 section 3(f) also requires that agencies reduce ILA water consumption, measured in gallons, by 2% annually through FY 2025 relative to a FY 2010 baseline.
## Water Use Efficiency & Management Strategies

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<tr>
<td>Install green infrastructure features to assist with storm and wastewater management.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations. In addition to federal and state regulatory drivers, NASA Centers are required to develop a management plan for both energy and water for the next 10 years to evaluate how they will meet water goals most efficiently. These plans address overall strategy, the needs of Center programs, the budget process, and organizational roles and responsibilities. The revised plans are due spring 2016 and reviewed during the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
<td>NA</td>
</tr>
<tr>
<td>Install and monitor water meters and utilize data to advance water conservation and management.</td>
<td>Yes</td>
<td>NASA Centers are responsible for installing meters to measure and monitor potable and industrial and landscaping water use where the activity justifies metering. NASA is installing water metering with upgrades to aging water distribution systems. NASA Centers have no agricultural water use. The Centers have some industrial and landscaping water uses, but most of this type of usage has historically been captured under potable water use. Landscaping is often associated with a building and would be part of that building’s water use. Some of the industrial water uses may merit separate metering and this will be evaluated.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year). NASA Centers are encouraged to install water metering when performing large remediation of buildings and new construction.</td>
</tr>
<tr>
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<tr>
<td>Install high efficiency technologies, e.g. WaterSense fixtures.</td>
<td>Yes</td>
<td>NASA Centers are responsible for purchase and installation of water efficient technologies for new buildings, and during upgrades and maintenance of existing buildings. NASA Centers have built numerous LEED® certified buildings and also installed many water efficient fixtures during building upgrades and maintenance projects. These efforts will continue with available resources.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
</tr>
<tr>
<td>Prepare and implement a water asset management plan to maintain desired level of service at lowest life cycle cost.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations. In addition to federal and state regulatory drivers, NASA Centers are required to develop a management plan for both energy and water for the next 10 years to evaluate how they will meet water goals most efficiently. These plans address overall strategy, the needs of Center programs, the budget process, and organizational roles and responsibilities. The revised plans are due spring 2016 and reviewed during the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
<td>NA</td>
</tr>
<tr>
<td>Minimize outdoor water use and use alternative water sources as much as possible.</td>
<td>Yes</td>
<td>NASA Centers are responsible for reducing the use of landscape irrigation to reduce water use, while considering safety (e.g., fire protection) and mission requirements. Many Centers, particularly those located in western states, are already utilizing water efficient landscaping. In addition Centers are installing low flow sprinkler heads and control systems.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
</tr>
<tr>
<td>Design and deploy water closed-loop, capture, recharge, and/or reclamation systems.</td>
<td>Yes</td>
<td>NASA Centers are responsible for reviewing their current systems and deploying water closed-loop, capture, recharge, and/or reclamation systems as appropriate. Many Centers have converted equipment to closed-loop systems. A couple of Centers have partnered with local communities to utilize reclamation systems.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
</tr>
<tr>
<td>Install advanced meters to measure monitor potable and ILA water use.</td>
<td>Yes</td>
<td>NASA Centers are responsible for installing meters to measure and monitor potable and industrial and landscaping water use where the activity justifies metering. NASA is installing water metering with upgrades to aging water distribution systems. NASA Centers have no agricultural water use. The Centers have some industrial and landscaping water uses, but most of this type of usage has historically been captured under potable water use. Landscaping is often associated with a building and would be part of that building’s water use. Some of the industrial water uses may merit separate metering and this will be evaluated.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year). NASA Centers are encouraged to install water metering when performing large remediation of buildings and new construction.</td>
</tr>
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</tr>
<tr>
<td>Develop and implement programs to educate employees about methods to minimize water use.</td>
<td>Yes</td>
<td>NASA Centers utilize various communication tools and develop new programs to educate employees about sustainable practices, including methods to minimize water use. Tools include formal training on the NASA SATERN on-line training system, newsletters, bulletins, and events such as Earth Day. Centers also maintain environmental websites that provide information on sustainability to employees.</td>
<td>Since NASA is meeting its water goals, NASA HQs will monitor for continual improvement through the Annual Energy/Water Report, NETS database, and the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
</tr>
<tr>
<td>Assess the interconnections and dependencies of energy and water on agency operations, particularly climate change's effects on water which may impact energy use.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations. In addition to federal and state regulatory drivers, NASA Centers are already required to develop a management plan for both energy and water. These plans address overall strategy, the needs of Center programs, the budget process, and organizational roles and responsibilities. The plans are reviewed during the triennial Environmental and Energy Functional Reviews (4-5 Centers/year).</td>
<td>NA</td>
</tr>
<tr>
<td>Consistent with State law, maximize use of grey-water and water reuse systems that reduce potable and ILA water consumption.</td>
<td>No</td>
<td>NASA Centers maximize use of grey-water where available.</td>
<td>NA</td>
</tr>
<tr>
<td>Consistent with State law, identify opportunities for aquifer storage and recovery to ensure consistent water supply availability.</td>
<td>No</td>
<td>The NASA mission requires Centers to ensure consistent water supply. Centers evaluate storage and recover opportunities when upgrading/revitalizing water distribution systems.</td>
<td>NA</td>
</tr>
<tr>
<td>Ensure that planned energy efficiency improvements consider associated opportunities for water conservation.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations. In addition to federal and state regulatory drivers, NASA Centers are required to develop a management plan for both energy and water for the next 10 years to evaluate how they will meet water goals most efficiently. These plans address overall strategy, the needs of Center programs, the budget process, and organizational roles and responsibilities. The revised plans are due spring 2016 and reviewed during the triennial Environmental and Energy Functional Reviews.</td>
<td>NA</td>
</tr>
<tr>
<td>Where appropriate, identify and implement regional and local drought management and preparedness strategies that reduce agency water consumption.</td>
<td>Yes</td>
<td>NASA is performing a climate risk management survey regarding water use, resources, and conservation measures at its Centers in the Southwest and West. The survey will support development of climate-risk management strategies.</td>
<td>NASA Centers to complete survey Spring of 2016; recommendations developed 2016-2017.</td>
</tr>
</tbody>
</table>
**Goal 5: Fleet Management**

**Fleet Petroleum Use Reduction Goal**

EO 13514 and the Energy Independence and Security Act of 2007 (EISA) required that by FY 2015 agencies reduce fleet petroleum use by 20% compared to a FY 2005 baseline.

**Chart: Progress Toward the Petroleum Reduction Goal**

![Chart showing progress toward petroleum reduction goal]

**Fleet Alternative Fuel Consumption Goal**

Agencies should have exceeded an alternative fuel use that is at least 5% of total fuel use. In addition, EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, required that agencies increase total alternative fuel consumption by 10% annually from the prior year starting in FY 2005. By FY 2015, agencies must have increased alternative fuel use by 159.4%, relative to FY 2005.

In FY 2015, NASA’s use of alternative fuel equaled 37% of total fuel use. NASA has increased its alternative fuel use by 190% since FY 2005.

**Fleet Per-Mile Greenhouse Gas (GHG) Emissions Goal**

EO 13693 Section 3(g) states that agencies with a fleet of at least 20 motor vehicles will improve fleet and vehicle efficiency and management. EO 13693 section 3(g)(ii) requires agencies to reduce fleet-wide per-mile GHG emissions from agency fleet vehicles relative to a FY 2014 baseline and sets new goals for percentage reductions: not less than 4% by FY 2017; not less than 15% by FY 2020; and not less than 30% by FY 2025.
EO 13693 Section 3(g)(i) requires that agencies determine the optimum fleet inventory, emphasizing eliminating unnecessary or non-essential vehicles. The Fleet Management Plan and Vehicle Allocation Methodology (VAM) Report are included as appendices to this plan.

**Chart: Fleet-wide Per-mile GHG Emissions**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fleet Efficiency (grams CO2/mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 Baseline</td>
<td>420.2</td>
</tr>
<tr>
<td>2015</td>
<td>356.0</td>
</tr>
<tr>
<td>2017 Target</td>
<td>403.4</td>
</tr>
<tr>
<td>2021 Target</td>
<td>357.2</td>
</tr>
<tr>
<td>2025 Target</td>
<td>294.2</td>
</tr>
</tbody>
</table>

**Fleet Management Strategies**

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<tr>
<td>Collect and utilize agency fleet operational data through deployment of vehicle telematics.</td>
<td>No</td>
<td>NASA is not investing in Telematics devices, as the ROI is not operationally beneficial.</td>
<td>NA</td>
</tr>
<tr>
<td>Ensure that agency annual asset-level fleet data is properly and accurately accounted for in a formal Fleet Management Information System as well as submitted to the Federal Automotive Statistical Tool reporting database, the Federal Motor Vehicle Registration System, and the Fleet Sustainability Dashboard (FLEETDASH) system.</td>
<td>Yes</td>
<td>Modify current FMIS to mirror projected FAST Vehicle Level Data elements. Incorporate – FAST Vehicle Level Data elements rules and modify current system to provide Vehicle Level Data to FAST.</td>
<td>Develop Task pricing and initiate development during FY 2017. Projected completion end of FY 2018. Based upon funding commitments.</td>
</tr>
<tr>
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</tbody>
</table>
| Increase acquisitions of zero emission and plug-in hybrid vehicles.     | Yes                  | Acquire Zero Emission vehicles during “end of life” cycles to match Agency infrastructure.                                                                                                                                                                                                                                                                                                                                | Inventory levels to meet FY 2017 36 EVs  
FY 2018 50 EVs  
FY 2019 60 EVs |
| Issue agency policy and a plan to install appropriate charging or refueling infrastructure for zero emission or plug-in hybrid vehicles and opportunities for ancillary services to support vehicle-to-grid technology. | Yes                  | Develop out-year planning of zero emission fleet vehicles.  
Develop current and out-year planning of POV zero emission vehicles.  
Develop policies and guidance on infrastructure and combined use of electrical access points for both Fleet and POV recharging.                                                                                                                                                                                                                       | End of FY 2016                                           |
| Optimize and right-size fleet composition, by reducing vehicle size, eliminating underutilized vehicles, and acquiring and locating vehicles to match local fuel infrastructure. | Yes                  | Each NASA Center conducts annual reviews of fleet vehicle utilization during the third quarter of the fiscal year. The reviews identify fleet units that fail to meet minimum utilization goals and then recommends disposition of the subject vehicle(s), in accordance with Agency disposition policy.  
During the 3rd quarter of the Fiscal Year, the CTO notifies organizations and the Center Director of vehicles not meeting the Center’s stated utilization goals and that further action may be taken regarding the disposition of the vehicle. Vehicles on the Utilization Target List will be evaluated for possible actions that include:  
a) Removal from the fleet  
b) Re-assignment within the Center  
c) Exchanged within the Center for another vehicle of a similar type with higher miles  
d) Exchanged within the Center for a different type of vehicle that better suits the mission  
e) Retention – provided additional justification  
Vehicles that have undergone a complete dispute resolution process and were approved for retention should still be considered for exchange with higher mileage units of a similar type whenever possible in order to “balance” utilization for the overall fleet. | All vehicle assignments are related to mission requirements and supported with valid justification. |
<p>| Increase utilization of alternative fuel in dual-fuel vehicles.         | Yes                  | Use of FleetDASH to monitor Alternative fuel use with the Agency fleet.                                                                                                                                                                                                                                                                                                                                               | Sustain an Agency missed opportunity rate of less than 5% |
| Use a FMIS to track real-time fuel consumption throughout the year for agency-owned, GSA-leased, and commercially-leased vehicles. | No                   | NASA’s FMIS does not track vehicle level data in “real-time” and therefore any real-time claim would be false. This statement is true for GSA’s Drive Thru program also.                                                                                                                                                                                                                                                        | NA                                                      |
| Implement vehicle idle mitigation technologies.                        | No                   | NASA’s choice not to install telematics limits the “possibility” of NASA to implement non-OEM technologies.                                                                                                                                                                                                                                                                                                                   | NA                                                      |</p>
<table>
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<tr>
<td>Minimize use of law enforcement exemptions by implementing GSA Bulletin FMR B-33, Motor Vehicle Management, Alternative Fuel Vehicle Guidance for Law Enforcement and Emergency Vehicle Fleets.</td>
<td>Yes</td>
<td>NASA utilizes the law enforcement (LE) vehicle classification system described in GSA Bulletin FMR B-33. However, no vehicle, law enforcement or otherwise, has been exempted from NASA’s VAM process.</td>
<td>As EO 13693 removes Law Enforcement and Emergency Vehicles from the GHG emissions calculation, Law Enforcement vehicles are not held to an official standard. However, within NASA all fleet standards are applied to all LE and E/ER vehicles the same as any other vehicle asset.</td>
</tr>
<tr>
<td>Where State vehicle or fleet technology or fueling infrastructure policies are in place, meet minimum requirements.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>Establish policy/plan to reduce miles traveled, e.g. through vehicle sharing, improving routing with telematics, eliminating trips, improving scheduling, and using shuttles, etc.</td>
<td>No</td>
<td>NASA use of vehicles is in the direct support of NASA Missions, Projects or Program; therefore, any plan to reduce miles would negatively impact success of Missions, Projects or Programs.</td>
<td>NA</td>
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Goal 6: Sustainable Acquisition

Sustainable Acquisition Goal

EO 13693 section 3(i) requires agencies to promote sustainable acquisition by ensuring that environmental performance and sustainability factors are considered to the maximum extent practicable for all applicable procurements in the planning, award and execution phases of acquisition.

Biobased Purchasing Targets

The Agricultural Act of 2014 requires that agencies establish a targeted biobased-only procurement requirement. EO 13693 section 3(iv) requires agencies to establish an annual target for increasing the number of contracts to be awarded with BioPreferred and biobased criteria and the dollar value of BioPreferred and biobased products to be delivered and reported under those contracts in the following fiscal year.

For FY 2017, NASA has established a target of 1,100 contracts and $1,000,000 in products to be delivered.
Chart: Percent of Applicable Contracts Containing Sustainable Acquisition Requirements

(Note that the sustainable acquisition progress chart will outline contract compliance for FY 2015, quarters 1, 2, 3, and 4, based on review of 5% of applicable contracts. In future SSPPs, Federal Procurement Data System (FPDS) data will also be used to demonstrate inclusion of sustainability criteria in procurements.)

**Sustainable Acquisition Strategies**
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<tr>
<td>Establish and implement policies to meet statutory mandates requiring purchasing preference for recycled content products, ENERGY STAR qualified and FEMP-designated products, and Biopreferred and biobased products designated by USDA.</td>
<td>No</td>
<td>Strategy is embedded in NASA acquisition as an ongoing activity.</td>
<td>NA</td>
</tr>
<tr>
<td>Establish and implement policies to purchase sustainable products and services identified by EPA programs, including SNAP, WaterSense, Safer Choice, and Smart Way.</td>
<td>No</td>
<td>Strategy is embedded in NASA acquisition as an ongoing activity.</td>
<td>NA</td>
</tr>
<tr>
<td>Strategy</td>
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</tr>
<tr>
<td>Update and deploy agency procurement policies to ensure environmentally preferable products and services that meet or exceed specifications, standards, or labels recommended by EPA are included in relevant procurements and services.</td>
<td>Yes</td>
<td>Issue revised NPR 8530.1A, Sustainable Acquisition.</td>
<td>Issue revised NPR 8530.1A, Sustainable Acquisition, by the end of FY 2016.</td>
</tr>
<tr>
<td>Use Category Management Initiatives and government-wide acquisition vehicles that already include sustainable acquisition criteria.</td>
<td>No</td>
<td>Strategy is embedded in NASA acquisition as an ongoing activity.</td>
<td>NA</td>
</tr>
<tr>
<td>Ensure contractors submit timely annual reports of their BioPreferred and biobased purchases.</td>
<td>Yes</td>
<td>NASA will execute the following: 1) Add FAR 52.223-2 as applicable 2) Verify contracting officer enters accurate data into FPDS to allow contractors to add biobased information into SAM 3) Maintain NASA Environmental Tracking System (NETS) to monitor progress.</td>
<td>Completion of FY 2016 data call entered into NETS.</td>
</tr>
<tr>
<td>Reduce copier and printing paper use and acquiring uncoated printing and writing paper containing at least 30% postconsumer recycled content or higher.</td>
<td>No</td>
<td>Strategy is embedded in NASA acquisition as an ongoing activity.</td>
<td>NA</td>
</tr>
<tr>
<td>Identify and implement corrective actions to address barriers to increasing sustainable acquisitions.</td>
<td>Yes</td>
<td>Develop a tool (cheat sheet) for contracting officers to efficiently determine FAR clause applicability.</td>
<td>Pilot FAR applicability Tool for contracting officers by December, 2016.</td>
</tr>
<tr>
<td>Improve quality of data and tracking of sustainable acquisition through the Federal Procurement Data System (FPDS).</td>
<td>Yes</td>
<td>NASA is statistically testing the reliability of its data in FPDS-Next Generation (NG). If the analysis indicates unreliable data, the cause or causes will be identified and steps taken to correct data entry.</td>
<td>By 2nd quarter FY 2017, will gather and statistically analyze the reliability of the data for FY 2015.</td>
</tr>
<tr>
<td>Incorporate compliance with contract sustainability requirements into procedures for monitoring contractor past performance and report on contractor compliance in performance reviews.</td>
<td>No</td>
<td>Not a priority at this time.</td>
<td></td>
</tr>
<tr>
<td>Review and update agency specifications to include and encourage products that meet sustainable acquisition criteria.</td>
<td>Yes</td>
<td>NASA will annually review 25% of the Master Specifications under its control and revise them to ensure that biobased and other designated green products are included as appropriate. This number of reviews will result in 100% of the total number of specifications under the control of NASA being reviewed for applicable green products during a 4-year cycle.</td>
<td>25% of NASA controlled Master Specifications updated annually.</td>
</tr>
<tr>
<td>Strategy</td>
<td>Priority for FY 2017</td>
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</tr>
<tr>
<td>Identify opportunities to reduce supply chain emissions and incorporate criteria or contractor requirements into procurements.</td>
<td>Yes</td>
<td>NASA will develop a Procurement Plan for Supply Chain GHG Reduction - as required by EO 13693 - and identify five new procurements that the Agency intends to award in FY 2017 that will require the awarded contractor to report GHG emissions and/or set GHG emission reduction targets.</td>
<td>Submit Procurement Plan for Supply Chain GHG Reduction by June 2016. Identify five new procurements that the Agency intends to award in FY 2017 that will require the awarded contractor to report GHG emissions and/or set GHG emission reduction targets.</td>
</tr>
<tr>
<td>[NASA] Complete contract reviews for biobased and FAR sustainability requirements during selected Center Environmental and Energy Functional Reviews (EEFRs) and Procurement Management Reviews (PMRs).</td>
<td>Yes</td>
<td>Complete representative sample contract reviews for selected Center EEFRs and PMRs.</td>
<td>Complete representative sample contract reviews of all selected Center EEFRs and PMRs.</td>
</tr>
</tbody>
</table>

**Goal 7: Pollution Prevention & Waste Reduction**

**Pollution Prevention & Waste Reduction Goal**

EO 13693 section 3(j) requires that Federal agencies advance waste prevention and pollution prevention and to annually divert at least 50% of non-hazardous construction and demolition debris. Section 3(j)(ii) further requires agencies to divert at least 50% of non-hazardous solid waste, including food and compostable material, and to pursue opportunities for net-zero waste or additional diversion.

Reporting on progress toward the waste diversion goal will begin with annual data for FY 2016.

**Pollution Prevention & Waste Reduction Strategies**

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted.*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Report in accordance with the requirements of sections 301 through 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C 11001-11023).</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>Reduce or minimize the quantity of toxic and hazardous chemicals acquired, used, or disposed of, particularly where such reduction will assist the agency in pursuing agency greenhouse gas reduction targets.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>Eliminate, reduce, or recover refrigerants and other fugitive emissions.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>Reduce waste generation through elimination, source reduction, and recycling.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
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<td>Priority for FY 2017</td>
<td>Strategy Narrative</td>
<td>Targets and Metrics</td>
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</tr>
<tr>
<td>Implement integrated pest management and improved landscape management</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>practices to reduce and eliminate the use of toxic and hazardous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemicals and materials.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Develop or revise Agency Chemicals Inventory Plans and identify and</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>deploy chemical elimination, substitution, and/or management</td>
<td></td>
<td></td>
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<tr>
<td>opportunities.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Inventory current HFC use and purchases.</td>
<td>Yes</td>
<td>Maintain NETS to capture HFC purchase and use data.</td>
<td>Work with NETS staff to include additional analytical capabilities for HFC, including</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>specific uses. Module modification will be implemented by FY 2016 data call in</td>
</tr>
<tr>
<td>Require high-level waiver or contract approval for any agency use of</td>
<td>No</td>
<td>Agency currently evaluating inventory and use data for necessity of waiver.</td>
<td>NA</td>
</tr>
<tr>
<td>HFCs.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ensure HFC management training and recycling equipment are available.</td>
<td>No</td>
<td>Strategy is embedded in Agency routine operations.</td>
<td>NA</td>
</tr>
<tr>
<td>[NASA] Include within the existing Environmental and Energy</td>
<td>Yes</td>
<td>Complete representative sample contract reviews for selected Center EEFRs. Agency</td>
<td>Will complete EEFR reviews at selected Centers.</td>
</tr>
<tr>
<td>Functional Reviews (EEFR’s) contract reviews to ensure appropriate</td>
<td></td>
<td>EEFR is a comprehensive environmental and energy review conducted at each NASA</td>
<td></td>
</tr>
<tr>
<td>solid waste reduction language.</td>
<td></td>
<td>Center on a three-year cycle.</td>
<td></td>
</tr>
<tr>
<td>[NASA] Maintain and improve Agency Websites for Recycling and</td>
<td>Yes</td>
<td>RSA provides technical resources and program implementation, maintains a web-</td>
<td>Continuously update the public RSA website and NASA internal RSA SharePoint site.</td>
</tr>
<tr>
<td>Sustainable (RSA) Acquisition Community of Practice.</td>
<td></td>
<td>based collaboration tool and website to share RSA work and to organize program</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>activities and initiatives on both individual and team levels.</td>
<td></td>
</tr>
<tr>
<td>[NASA] Host quarterly series of web-based sessions for Agency</td>
<td>Yes</td>
<td>Complete 4 sessions for Agency/Center updates and RSA-related training.</td>
<td>Complete 4 sessions.</td>
</tr>
<tr>
<td>participants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[NASA] Maintain a tracking and reporting system for construction and</td>
<td>Yes</td>
<td>Maintain NASA Environmental Tracking System (NETS) to include a comprehensive</td>
<td>Completion of FY 2016 data call by March, 2017. Additional development of NETS</td>
</tr>
<tr>
<td>demolition debris elimination.</td>
<td></td>
<td>tracking and reporting database that includes construction and demolition</td>
<td>modules as requested by Centers for solid waste diversion, including construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>debris and non-construction solid waste data (current and historical).</td>
<td>and demolition debris.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuously expand/refine NASA dashboard within NETS that provides visual</td>
<td></td>
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<td></td>
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<td>representation and trending analysis.</td>
<td></td>
</tr>
</tbody>
</table>
Goal 8: Energy Performance Contracts

Performance Contracting Goal

EO 13693 section 3(k) requires that agencies implement performance contracts for Federal buildings. EO 13693 section 3(k)(iii) also requires that agencies provide annual agency targets for performance contracting. NASA awarded $114.3M investment value in Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESCs) through March 2016. This surpasses by $40.4M our President’s Performance Contracting Challenge pledge to award $73.9M by the end of 2016. Under Phase 2 of the Challenge, NASA awarded four projects including the agency’s first combined heat and power (CHP) system. The CHP ESPC represents the largest investment value energy performance contract ever awarded by NASA.

In response to EO 13693’s challenging energy goals, NASA initiated an effort to develop a Strategic Energy Investment Plan with Department of Energy and industry support. The Plan will provide information to help NASA senior leaders understand and prioritize energy efficiency, renewable electric energy, and clean energy opportunities across the Agency in support of NASA’s mission and greenhouse gas emission reductions. Because the planning will occur during FY 2016 and FY 2017, NASA is refraining from setting energy performance contract investment value targets for FY 2017 and FY 2018 in this 2016 SSPP.

Chart: Progress Toward Target under the President’s Performance Contracting Challenge
## Performance Contracting Strategies

*Please note: Strategies are provided by CEQ/OMB, unless otherwise noted. Orange text indicates Strategy has been modified for NASA’s use.*

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Utilize performance contracting to meet identified energy efficiency and management goals while deploying life-cycle cost effective energy and clean energy technology and water conservation measures.</td>
<td>Yes</td>
<td>NASA has utilized Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESCs) to support mission and contribute to Federal energy/water requirements since the 1990s and plans to continue utilizing these important tools.</td>
<td>Implementation and monitoring effectiveness of FY 2015 and FY 2016 energy performance contracts during FY 2016 and FY 2017.</td>
</tr>
<tr>
<td>Fulfill existing agency target/commitments towards the Presidential Performance Contracting Challenge (PPCC) by the end of CY16.</td>
<td>Yes</td>
<td>During the PPCC, NASA awarded $114.3M investment value in Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESCs) through March 2016.</td>
<td>Award of $73.9M investment value in Energy Savings Performance Contracts (ESPCs) and Utility Energy Services Contracts (UESCs) by the end of 2016 (PPCC target as revised at start of Phase 2).</td>
</tr>
<tr>
<td>Evaluate 25% of agency's most energy intensive buildings for opportunities to use ESPCs/UESCs to achieve goals.</td>
<td>No</td>
<td>NASA annually requests exclusions from Federal energy intensity reduction requirements for our most energy intensive facilities. The highly specialized and mission variable nature of these facilities typically does not align with energy performance contract mechanisms.</td>
<td></td>
</tr>
<tr>
<td>Prioritize top portfolio-wide projects that will provide greatest energy savings potential.</td>
<td>Yes</td>
<td>NASA initiated an effort to develop a Strategic Energy Investment Plan with Department of Energy and industry support. The Plan will provide information to help NASA senior leaders understand and prioritize energy efficiency, renewable electric energy, and clean energy opportunities across the Agency in support of NASA's mission and greenhouse gas emission reductions.</td>
<td>Development of Strategic Energy Investment Plan during FY 2016 and FY 2017.</td>
</tr>
<tr>
<td>Identify and commit to include onsite renewable energy projects in a percentage of energy performance contracts.</td>
<td>No</td>
<td>NASA is developing a Strategic Energy Investment Plan--see above.</td>
<td></td>
</tr>
<tr>
<td>Submit proposals for technical or financial assistance to FEMP and/or use FEMP resources to improve performance contracting program.</td>
<td>No</td>
<td>NASA is developing a Strategic Energy Investment Plan--see above.</td>
<td></td>
</tr>
<tr>
<td>Work with FEMP/USACE to cut cycle time of performance contracting process, targeting a minimum 25% reduction.</td>
<td>No</td>
<td>NASA is developing a Strategic Energy Investment Plan--see above.</td>
<td></td>
</tr>
<tr>
<td>Ensure agency legal and procurement staff are trained by the FEMP ESPC/UESC course curriculum.</td>
<td>No</td>
<td>NASA is developing a Strategic Energy Investment Plan--see above.</td>
<td></td>
</tr>
</tbody>
</table>
Goal 9: Electronics Stewardship & Data Centers

Electronics Stewardship Goals
EO 13693 Section 3(l) requires that agencies promote electronics stewardship, including procurement preference for environmentally sustainable electronic products; establishing and implementing policies to enable power management, duplex printing, and other energy efficient or environmentally sustainable features on all eligible agency electronic products; and employing environmentally sound practices with respect to the agency's disposition of all agency excess or surplus electronic products.

Agency Progress in Meeting Electronics Stewardship Goals

Procurement Goal:
At least 95% of monitors, PCs, and laptops acquired meet environmentally sustainable electronics criteria (EPEAT registered).
FY 2015 Progress: 95%

Power Management Goal:
100% of computers, laptops, and monitors have power management features enabled.
FY 2015 Progress: 100% of equipment has power management enabled.
0% of equipment has been exempted.

End-of-Life Goal:
100% of electronics disposed using environmentally sound methods, including GSA Xcess, Computers for Learning, UNICOR, U.S. Postal Service Blue Earth Recycling Program, or Certified Recycler (R2 or E-Stewards).
FY 2015 Progress: 100% of electronics are disposed using environmentally sound methods.

Data Center Efficiency Goal
EO 13693 Section 3(a) states that agencies must improve data center efficiency at agency facilities, and requires that agencies establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers.

NASA has developed a standard methodology to calculate PUE at each of its 11 enterprise data centers. This methodology was developed because installing meters in all existing data centers is cost prohibitive. The PUE for the remaining 9 non-enterprise data centers will be calculated using an industry PUE modeling tool per the FITARA date of September 30, 2018. Once individual data center PUEs are determined with the more cost effective NASA standard methodology, we can work on instituting best practices to lower their PUEs. Achieving the 1.5 PUE goal will be a challenge given the advanced age of several of the data center buildings and the cost of modifications to achieve substantial energy efficient improvements. As NASA increases the density in data centers by consolidation and has the opportunity to implement more energy savings best practices over time, PUE will improve.
## Electronics Stewardship Strategies

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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Use government-wide strategic sourcing vehicles to ensure procurement of equipment that meets sustainable electronics criteria.</td>
<td>Yes</td>
<td>NASA leverages a single Agency-wide procurement vehicle to provide at least 80% of our computer, mobile, and peripheral devices. IAW OMB Category Management Policy 15-1 NASA will procure the remaining laptop and desktop devices through approved strategic sourcing vendors.</td>
<td>1/1/2017 100% of NASA laptop and desktop systems will be procured through approved sourcing vehicles that ensure compliance with sustainable electronics criteria.</td>
</tr>
<tr>
<td>Enable and maintain power management on all eligible electronics; measure and report compliance.</td>
<td>Yes</td>
<td>Power management is enabled on workstations by default and the settings are maintained through automated controls that allow only system administrators to change settings.</td>
<td>100% of deployed workstations have power management features enabled.</td>
</tr>
<tr>
<td>Implement automatic duplexing and other print management features on all eligible agency computers and imaging equipment; measure and report compliance.</td>
<td>Yes</td>
<td>Policies/Procedures associated with the Agency’s Desktop Outsourcing contract (ACES) now default to requiring power management and duplex printing.</td>
<td>Metric: 100% compliance for duplex, power save, and ink optimization settings across all enterprise printing devices. Metrics/Measurement strategy: Various contract compliance metrics for the contractors providing enterprise printing services to include Toner and Waste Disposal Plan (DRD-IT02).</td>
</tr>
<tr>
<td>Ensure environmentally sound disposition of all agency excess and surplus electronics, consistent with Federal policies on disposal of electronic assets, and measure and report compliance.</td>
<td>Yes</td>
<td>NASA will continue to use eSteward and R2 electronic recyclers.</td>
<td>Metric: 100% compliance. Metrics/Measurement strategy: Annual waste/disposal reports are submitted to NASA Headquarters to complete the annual report on affirmative procurement, waste reduction, energy efficient procurement and ozone depleting substances.</td>
</tr>
<tr>
<td>Improve tracking and reporting systems for electronics stewardship requirements through the lifecycle: acquisition and procurement, operations and maintenance, and end-of-life management.</td>
<td>No</td>
<td>Strategy already implemented.</td>
<td>NA</td>
</tr>
</tbody>
</table>
## Data Center Efficiency Strategies

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</thead>
<tbody>
<tr>
<td>Develop, issue and implement policies, procedures and guidance for data center energy optimization, efficiency, and performance.</td>
<td>No</td>
<td>This is not a priority for FY 2017.</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Measure and actively manage energy and power usage effectiveness.</strong></td>
<td>Yes</td>
<td>The installation of advanced energy metering is cost prohibitive with a poor return on investment (ROI), but NASA can meet the intent of this strategy by a standard methodology developed to calculate PUE at each of its 11 enterprise data centers. This methodology was developed because installing meters in all existing data centers is cost prohibitive. The remaining 9 non-enterprise data centers PUE will be calculated using an industry PUE modeling tool.</td>
<td>12/30/2016 - Calculate PUE for 9 of 11 Enterprise data centers across NASA. The remaining 2 are TBD and based on construction completion of a data center. 12/31/2017 - Complete the PUE calculation for all of NASA's 20 remaining data centers.</td>
</tr>
<tr>
<td>Minimize total cost of ownership in data center and cloud computing operations.</td>
<td>Yes</td>
<td>NASA will implement a total cost of ownership (TCO) model to yield cost savings and cost avoidance estimates as a result of Agency data center consolidation efforts.</td>
<td>6/30/2016 - Complete DoD Hybrid NASA TCO model to identify cost saving from 2011 - 2015 and 2016 - 2018. 12/31/2017 - Continue to update Quarterly OMB Inventory Data Calls.</td>
</tr>
<tr>
<td>Identify, consolidate and migrate obsolete, underutilized and inefficient data centers to more efficient data centers or cloud providers; close unneeded data centers.</td>
<td>Yes</td>
<td>The Agency Data Center Project will provide Annual Report Card measuring individual data center performance based on virtualization, facility utilization, and PUE trends. Based on results, will identify options for consolidating and/or migrating underutilized and inefficient data centers.</td>
<td>6/30/2016 - Provide Yearly Report Card to Center CIOs on a per data center basis. 6/30/2017 - Annual Report</td>
</tr>
<tr>
<td>Improve data center temperature and air-flow management to capture energy savings.</td>
<td>No</td>
<td>Other strategies are a higher priority for FY 2017.</td>
<td>NA</td>
</tr>
<tr>
<td>Assign certified Data Center Energy Practitioner(s) to manage core data center(s).</td>
<td>Yes</td>
<td>Identify key local Center operations personnel who are knowledgeable in facility power distribution to include generators, UPS, HVAC systems, chilled water and facility power metering. Have the identified Center operations key personnel work with the Centers’ Energy Manager to educate and establish certification in energy management.</td>
<td>12/31/2016 - Identify key local Center operations personnel who are knowledgeable in facility power distribution to include generators, UPS, HVAC systems, chilled water and facility power metering. 9/30/2017 - Have the identified Center operations key personnel work with the Centers’ Energy Manager to educate and establish certification in energy management.</td>
</tr>
</tbody>
</table>
Goal 10: Climate Change Resilience

EO 13653, *Preparing the United States for the Impacts of Climate Change*, outlines Federal agency responsibilities in the areas of supporting climate resilient investment; managing lands and waters for climate preparedness and resilience; providing information, data and tools for climate change preparedness and resilience; and planning.

EO 13693 Section 3(h)(viii) states that as part of building efficiency, performance, and management, agencies should incorporate climate-resilient design and management elements into the operation, repair, and renovation of existing agency buildings and the design of new agency buildings. In addition, Section 13(a) requires agencies to identify and address projected impacts of climate change on mission critical water, energy, communication, and transportation demands and consider those climate impacts in operational preparedness planning for major agency facilities and operations. Section 13(b) requires agencies to calculate the potential cost and risk to mission associated with agency operations that do not take into account such information and consider that cost in agency decision-making.

Climate Change Resilience Strategies

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<tr>
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</thead>
<tbody>
<tr>
<td>Strengthen agency <em>external</em> mission, programs, policies and operations (including grants, loans, technical assistance, etc.) to incentivize planning for, and addressing the impacts of, climate change.</td>
<td>No</td>
<td>This does not apply to NASA as it does not have in its mission “investment through grants, loans or other financial incentives.” NASA is governed by Section 4.0 - Limitations in its <a href="https://www.nasa.gov/content/nasa-grant-and-cooperative-agreement-manual">NASA Grant and Cooperative Agreement Manual</a>, which restricts NASA grants and cooperative agreements from being “used as legal instruments for facility design and construction services to NASA (Section 4.6).” The only exception to these limitations is under Section 4.8, “Requesting an exception to facility, real estate, real property or construction limitations: it is unlikely that an award to create or enhance a facility or to purchase real estate or property will be approved unless specifically authorized by Congress.”</td>
<td>NA</td>
</tr>
<tr>
<td>Update and strengthen agency <em>internal</em> mission, programs, policies, and operations to align with the Guiding Principles, including facility acquisition, planning, design, training, and asset management processes, to incentivize planning for and addressing the impacts of climate change.</td>
<td>Yes</td>
<td>NASA will increase staff awareness though climate risk management training and related enrichment events.</td>
<td>Progress measured by staff participation in training and enrichment events, and by seeing climate-aware decision-making reflected in routine processes such as capital investment planning.</td>
</tr>
<tr>
<td>Strategy</td>
<td>Priority for FY 2017</td>
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</tr>
<tr>
<td>Update emergency response, health, and safety procedures and protocols to account for projected climate change, including extreme weather events.</td>
<td>Yes</td>
<td>NASA has Directives &amp; Requirements system that includes emergency response procedures and protocols that are on a scheduled update process.</td>
<td>NASA will investigate its Procedures and Requirements for outdated response procedures and protocols concerning extreme weather events and initiate updates as appropriate.</td>
</tr>
<tr>
<td>Ensure climate change adaptation is integrated into both agency-wide and regional planning efforts, in coordination with other Federal agencies as well as state and local partners, Tribal governments, and private stakeholders.</td>
<td>Yes</td>
<td>NASA will engage with external stakeholders to advance understanding of and expertise in responding to regional climate risks of shared concern.</td>
<td>Progress measured by number of and participation in regional efforts together with resulting or related studies &amp; reports.</td>
</tr>
<tr>
<td>Ensure that vulnerable populations potentially impacted by climate change are engaged in agency processes to identify measures addressing relevant climate change impacts.</td>
<td>No</td>
<td>When NASA takes an action (programmatic or institutional in nature) of consequence for the environment, we apply NEPA to ensure that we have considered the potential for disproportionate impact to vulnerable populations. As a mature program, this is not a priority strategy for NASA to advance at present.</td>
<td>NA</td>
</tr>
<tr>
<td>Identify interagency climate tools and platforms used in updating agency programs and policies to encourage or require planning for, and addressing the impacts of climate change.</td>
<td>Yes</td>
<td>NASA will explore new climate adaptation tools (e.g., RETScreen, downscaled climate projections) to promote climate-aware local decision-making.</td>
<td>Progress measured by number of and participation in events that showcase or demonstrate such climate tools.</td>
</tr>
</tbody>
</table>

FY 2016
Fleet Management Plan
and Budget Narrative

for the

National Aeronautics
and
Space Administration
(NASA)
(A) **Introduction that describes the agency mission, organization, and overview of the role of the fleet in serving agency missions.**

NASA conducts its work in four principal organizations, called mission directorates:

- **Aeronautics**: manages research focused on meeting global demand for air mobility in ways that are more environmentally friendly and sustainable, while also embracing revolutionary technology from outside aviation.
- **Human Exploration and Operations**: focuses on International Space Station operations, development of commercial spaceflight capabilities and human exploration beyond low-Earth orbit.
- **Science**: explores the Earth, solar system and universe beyond; charts the best route of discovery; and reaps the benefits of Earth and space exploration for society.
- **Space Technology**: rapidly develops, innovates, demonstrates, and infuses revolutionary, high-payoff technologies that enable NASA's future missions while providing economic benefit to the nation.

In the early 21st century, NASA's reach spans the universe. The [Mars Rover Curiosity](https://www.nasa.gov/mission_pages/mars/curiosity/main/index.html) met its major science objective -- finding evidence of a past environment suitable for microbial life -- in the first eight months of a planned 23-month mission, and now is continuing to look for more information about the habitability of the Martian environment. [Cassini](https://www.nasa.gov/mission_pages/cassini/index.html) remains studying the Saturn system, as [Juno](https://www.juno.sci.gsfc.nasa.gov/) makes its way to Jupiter. The restored [Hubble Space Telescope](https://www.space望远镜) continues to explore the deepest reaches of the cosmos as NASA develops the [James Webb Space Telescope](https://www.nasa.gov/mission_pages/jwst/index.html).

Closer to home, the crews of the [International Space Station](https://wwwщен) are extending the permanent human presence in space and performing research that will help us understand how humans can live and work off Earth for long periods. Working with U.S. commercial companies to develop spacecraft capable of carrying humans and cargo to the International Space Station, NASA is helping to foster the development of private-sector aerospace while also building the Orion spacecraft and Space Launch System rocket to send humans into deep space.

[Earth science](https://www.nasa.gov/earth) satellites are sending back unprecedented data on Earth's oceans, climate and other features. NASA's [aeronautics](https://www.nasa.gov/aeronautics) team is working with other government organizations, universities, and industry to fundamentally improve the air transportation experience and retain our nation's leadership in global aviation.

**NASA’s Future**

Even with the retirement of the agency's space shuttles in 2011, NASA has a robust program of exploration, technology development and scientific research that will last for years to come. Here is [what's next for NASA](https://www.nasa.gov/mission_pages/home/index.html):

- NASA is designing and building the capabilities to send humans to explore beyond Earth orbit, including the development of the Orion spacecraft and Space Launch System rocket, working toward a goal of sending astronauts to an asteroid in the coming decade and then to Mars by the 2030s.
- The International Space Station is fully staffed with a crew of six, and American astronauts will continue to live and work there in space 24 hours a day, 365 days a year. Part of the U.S. portion of the station has been designated as a national laboratory, and NASA is committed to using this unique resource for wide-ranging scientific research.
- U.S. commercial companies have begun delivering cargo to the space station, and commercial industry partners are working with NASA to develop new spacecraft and rockets to transport astronauts to and from low-Earth orbit, allowing NASA to focus its attention on the next steps into our solar system.
- NASA is researching ways to design and build aircraft that are safer, more fuel-efficient, quieter, and environmentally responsible. NASA also is part of the government team that is working to develop the Next Generation Air Transportation System, or NextGen, to be in place by the year 2025.
- NASA is conducting an unprecedented array of science missions that will seek new knowledge and understanding of Earth, the solar system and the universe.
NASA’s vehicle fleet assets are provided for administrative infrastructure or to support funded mission(s) in order to accomplish activities approved as part of NASA’s mission directorates.

NASA’s end of FY 2015 fleet assets consisted of 3,027 assets including: 247 Low Speed Electric Vehicles, 447 sedans, 1,066 light duty trucks (including vans), 649 medium duty trucks, 318 heavy duty trucks, 20 ambulances and 39 buses.

(B) Criteria for justifying and assigning vehicles (including home-to-work vehicle assignments).

The process of justifying vehicle requirements is based on mission/program requirements, therefore establishing the approved fleet inventory for the Agency based upon approved Appropriated funded missions; allowing the vehicle inventory to adjust with NASA’s administrative/mission changes inline with Appropriated funding approval, or upon reaching program/contracting milestones. Vehicle assets are reviewed and validated annually to ensure vehicle requirements are properly allocated and utilized based on those approved program/mission requirements.

NASA’s policies provide guidance against assigning Government motor vehicles for the exclusive use of any one official unless such assignment is required by the nature of the individual’s responsibilities or by the frequency, urgency, and extent of daily usage.

Additionally, NASA does not authorize the use of Government motor vehicles for the transportation of employees between their residences and places of work, except for:

- Individuals on valid travel authorization in accordance with the Federal Travel Regulations and NASA Procedural Requirement # 9700.1 Travel.
- Office of the Inspector General’s (OIG) personnel performing criminal law enforcement functions pursuant to statutory authority.
- Incumbents assigned as NASA Representatives located in Moscow, Russia.

(C) Vehicle Allocation Methodology (VAM) target development and explanation for reported fleet size and cost changes or not meeting agency VAM targets.

NASA Procedural Directives and NASA Procedural Requirements documents set forth transportation and general traffic management responsibilities and procedures governing the use of commercial and Government transportation resources.

Additionally, NASA provides guidance to Center Transportation Officers (CTOs) through NASA’s Fleet Management Handbook for specific actions addressing the requirements of the Vehicle Allocation Methodology. These guidelines support NASA policies by requiring analysis and adjustments to be conducted during annual Vehicle Utilization Review Boards (VURBs) or in response to programmatic challenges.

NASA CTOs exercise management and control over all assigned vehicles. The CTOs annually evaluate NASA’s vehicle fleet for both existing vehicle assignments and reviewing new requests for transportation support. Each Center maintains an approved list of vehicle assignments as part of their Table of Authorized Vehicles (TAV). The list includes government-furnished vehicles that are assigned, operated, and maintained by the contractors. Additional vehicle assignments must be related to mission change and supported with valid justification (Form NF 1759). NASA’s HQ Agency Transportation Manager must approve any acquisitions that exceed the approved TAV in advance of the acquisition. Centers are strongly encouraged to maintain a zero growth policy.
The following process/factors are considered as each CTO develops its vehicle baseline:

a) Require each customer to submit a written justification for each additional assignment using NASA Form NF 1759.

b) The CTO evaluates each submission, focusing on what the vehicle is used for in terms of passenger movement, cargo movement, material movement, or mission essentiality of the vehicle.

c) The CTO reviews the requirement and advises the best overall solution to support the smallest sized vehicle option, which still meets the requirements of the mission/program.

d) The CTO must consider other means of support besides assigning a vehicle asset; i.e., Privately-Owned Vehicle, taxi, bus, pool vehicle, rental vehicle, shared vehicle or Low Speed Electric Vehicle (LSEV).

e) Analyze past and expected utilization: if only 25% of average utilization is currently being met, continued assignment may not be warranted.

f) Types of assignments for each customer shall be based on the specific requirements of each customer. Therefore, assignment of Government-owned or leased vehicles may be permanent or temporary.

g) Develop preliminary TAV based on evaluation of the data captured on each Form NF 1759, showing current and recommended levels.

h) Coordinate findings with customers and offer opportunity for rebuttal, especially if recommendation is to reduce assignments.

i) Consider customer recommendations and then make final decision on baseline mix.

j) Retain TAV level and only adjust when mission changes warrant.

k) Once the customer baseline TAV is established, develop a baseline TAV for pool vehicles if applicable.

Note: Center Transportation Officers who already have an established and approved baseline in place are not required to re-establish the baseline.

NASA’s Fleet Management Handbook, Chapter 4 sets performance metrics including utilization. As each Center varies in fleet size and mission, each Center establishes minimum miles and hours for determining underutilization. Travel log(s) can help evaluate vehicle utilization and their use is encouraged in sub-pools or other appropriate areas. If applied, the recommended transaction data recorded within travel logs should include; number of trips per month, mileage per trip, total mileage per month, check-out date and time, and check-in date and time.

Each NASA Center conducts annual reviews of fleet vehicle utilization during the third quarter of the fiscal year. The reviews identify fleet units that fail to meet minimum utilization goals and then recommends disposition of the subject vehicle(s), in accordance with Agency disposition policy.

During the 3rd quarter of the Fiscal Year, the CTO notifies organizations and the Center Director of vehicles not meeting the Center’s stated utilization goals and that further action may be taken regarding the disposition of the their vehicle. Vehicles are on the Utilization Target List will be evaluated for possible actions that include:

a) Removal from the fleet

b) Re-assignment within the Center

c) Exchanged for another vehicle of a similar type with higher miles

d) Exchanged for a different type of vehicle that better suits the mission

e) Retention – provided additional justification

Vehicle users may request exemptions to the minimum mileage specified for assignment or retention of a fleet vehicle. Other utilization goals such as passengers or tonnage carried or hours used should be applied if mileage is not an accurate measurement for a particular vehicle’s mission. Mileage accumulated on these types of vehicles should not be included in the annual mileage target for the fleet.

Vehicles that have undergone a complete dispute resolution process and were approved for retention should still be considered for exchange with higher mileage units of a similar type whenever possible in order to “balance” utilization for the overall fleet.

(D) Description of efforts to control fleet size and cost.
In FY 2011 NASA Center Vehicle Utilization Review Boards (VURBs), contractor input, including Center Transportation Officer(s) projected a 14% reduction in vehicle fleet assets through FY 2015, and NASA represented this projected reduction as “NASA’s 2015 optima fleet” of 3,305 vehicles within the Vehicle Allocation Methodology (VAM) submitted in FY 2012.

Changes within administrative direction related to programming and/or mission funding have influenced the projected fleet inventory count for FY 2015 to a count of 3,314 vehicles.

Reported future cost projections are based upon historical trends and use a flat across-the-board 3.5 percentage increase on current FY acquisition and maintenance cost figures.

**(E) Explanation of how law enforcement vehicles are categorized within the agency (See FMR Bulletin B-33).**

NASA utilizes the law enforcement (LE) vehicle classification system described in GSA Bulletin FMR B-33. However, no vehicle, law enforcement of otherwise, has been exempted from NASA’s VAM process.

**(F) Justification for restricted vehicles.**

NASA policy does not allow for “executive vehicles”, as defined in 41 C.F.R. 102-34.50. NASA posts a negative report on its public website in support of this policy.

**(G) Description of vehicle replacement strategy and results.**

NASA’s Fleet Management Plan highlights the Agency’s commitment to achieving all Fleet Performance metrics and the policies and processes we have established to assure success.

NASA’s strategies are:

1) Acquire Alternative Fuel Vehicles (AFVs), Flex Fuel Vehicles (FFVs) or Low Greenhouse Gas (GHG) emitting vehicles during “end of life cycle” replacements, for the current vehicle requirements.

2) Optimize the assignment of current Alternative Fuel Vehicle assets to locations capable of providing access to Alternative Fuel.

3) Acquire gasoline dedicated Low Greenhouse Gas (CO2 emission) emitting vehicles in locations where alternative fuel is not available; including those locations where alternative fuel has a history of being commercially unrealable.

4) Conduct cost analysis to determine the best vehicle sourcing method(s) by comparing cost of owned vehicles to leased vehicles; including all direct and indirect costs projected for identical lifecycles.

NASA ended FY 2014 with a reduction within its fleet of 32 vehicles compared to its end of FY 2013 fleet and by 351 vehicles compared to its end of FY 2011 fleet. NASA’s Vehicle Allocation Methodology has proven to be an effective vehicle management tool by demonstrating a total vehicle reduction from a high point of 4,025 vehicles (FY 2006) to the current vehicle inventory of 3,314.
(H) Description of the agency-wide Vehicle Management Information System (See FMR Bulletin B-15).

NASA has traditionally collected Fleet Management Information System (FMIS) data at Center level (NASA has 14 Centers within its Agency), and rolled the data up to perform analysis or report Agency information.

In 2013, NASA HQ funded a Transportation Fleet Management System Development Plan, which is 80 percent for Federal Automotive Statistical Tool reporting in Oct of 2015. The changes forecasted in E.O. 13693 will have dramatic impact of the need to further develop additional functionality and such development costs were not forecasted into FY 2015 FMIS budget.

In effort to pursue an Agency-wide level Transportation FMIS meeting the standards set within E.O. 13693 and the implementing instructions which define future data requirements, NASA will:

a) identify and collect accurate inventory, cost and utilization data that covers the complete lifecycle of each motor vehicles (acquisition, operation, maintenance and disposal), at the asset level;

b) provide the information necessary to satisfy both internal and external reporting requirements including:

1) cost per mile,

2) fuel costs for each motor vehicle,

3) data required for Federal Automotive Statistical Tool (FAST).

The selection of an IBM product "Maximo for Transportation" and a contractor to perform the acquisition, installation and development of the MAXIMO system implementation has been completed.

In an effort to integrate and simplify NASA’s Fleet management reporting, NASA conducted research into the GSA suggestion of a single Fleet Management Information System.

- NASA discovered currently no system; including GSA’s FedFMS offers a single software solution to Fleet Management reporting requirements.

- One observation noted was that GSA cannot/will not share its leased fleet information with other software systems.

- Even within GSA's FedFMS, Agency owned and GSA leased vehicle data is not collected and exacted within a single reporting software tool.
  - Agencies are required to enter into a second GSA system and download files from GSA's leased information system, then upload that information into the FedFMS prior to being able to exact entire vehicle fleet data information.
  - GSA’s systems fails to merge leased vehicle data with owned vehicle data.
  - GSA’s recommendation to use a single fleet management system is not attainable, even when using GSA's supported FedFMS.

(I) Plans to increase the use of vehicle sharing.
NASA currently does not employ the use of “shared vehicle” fleets. However, NASA rents vehicles during high volume peaks of activity at Centers, with GSA Automotive Group being NASA’s preferred vendor for this activity. NASA applies a vigorous process to vehicle sourcing, as documented in NASA’s Fleet Management Handbook and as earlier identified. The Handbook Section 2.3.4, outlines actions to consider during acquisition, including alternatives. Additionally, Handbook Section 2.3.4.6 states: “The most economical and efficient means of transportation will be provided in all cases.” specifically addressing the intent of GSA’s recommendation. NASA’s Fleet Management Plan clearly identifies “i.e., POV, taxi, bus, pool vehicle or Low Speed Electric Vehicle (LSEV).”

(J) Impediments to optimal fleet management.

“Optimal” fleet inventory should be understood to be a moving target. Today’s optimal fleet may or may not be the same as yesterday’s optimal fleet, and may be outdated by next week.

“Optimal management of a fleet” is a more accurate name of NASA’s process. NASA’s fleet must be allowed to grow or shrink as program’s/mission’s scope increased or decrease. The pre-existing “optimal fleet” is reviewed and managed to meet the needs of new program or mission workloads through a management process; adjusting to those changes using established policies and practices. NASA fleet management adjusts today’s fleet to meet today’s needs, therefore making today’s fleet “optimal”.

NASA’s primary impediment to optimal fleet management (as GSA calls it) is an outside belief that optimal fleet management can be predicted 5 years into the future to exact numbers, based on the needs of programs and missions that will be five years “out of date” when the 2015 fleet is reviewed.

Additionally, the availability of publicly available alternative fuel infrastructure in concerning. There will continue to be areas where there are no realistic solutions for AFVs, particularly in selected parts of the country.

(K) Anomalies and possible errors.

In 2015 NASA subfleets will report fuel, mileage and costs for “fleets” (within FAST), which appear to have no inventory.

In fact, the use of MAXIMO for Transportation will in future FYs only reflect asset level reporting and not BOAC summary level reporting. Those subfleets do in fact have inventory, but the inventory will be reported in a format that is developed to meet 2018 FAST reporting formatting. Therefore, FAST BOACs will show actual costs, fuel usage and mileage driven against what appears to be an inventory containing zero vehicles.

(L) Summary and contact information.

Timothy A. Currie
NASA Agency Transportation Manager
Logistic Management Division
NASA Headquarters
300 E Street SW, Room 2W73
Washington, DC 20546-0001
### VAM/FAST Inventory Year-to-Year Comparison

This report compares the most recent VAM Summary provided by your agency against the actual inventory (for years available) and planned inventory numbers reported by your agency during the annual FAST data call. It is expected that these two data sets will follow each other over the life of the VAM as your agency works toward an optimal fleet. Significant differences between the two (greater than 20%) will be highlighted in yellow and should be addressed in your Fleet Management Plan and Budget Summary document to be submitted to GSA/OMB each year.

<table>
<thead>
<tr>
<th>VAM Summary</th>
<th>Sedan</th>
<th>Other</th>
<th>Truck</th>
<th>Other</th>
<th>Total</th>
<th>% Mix</th>
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<tr>
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<td>3%</td>
<td>6%</td>
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<td><strong>Total</strong></td>
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<td>605</td>
<td>765</td>
<td>0</td>
<td>2,131</td>
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<td><strong>Total</strong></td>
<td>810</td>
<td>719</td>
<td>1,715</td>
<td>103</td>
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</tr>
<tr>
<td><strong>% Mix</strong></td>
<td>24%</td>
<td>21%</td>
<td>51%</td>
<td>3%</td>
<td>25%</td>
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<td><strong>2015 Actual Inventory</strong></td>
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<td>Conventional Fuel Vehicles</td>
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<td>109</td>
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<td>Alternative Fuel Vehicles</td>
<td>642</td>
<td>582</td>
<td>765</td>
<td>5</td>
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<td>691</td>
<td>1,583</td>
<td>59</td>
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<td></td>
</tr>
<tr>
<td><strong>% Mix</strong></td>
<td>23%</td>
<td>23%</td>
<td>52%</td>
<td>2%</td>
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Appendix B: Multi-Modal Access Plan

National Aeronautics and Space Administration
FY 2016 Multimodal Access Plan (MAP)

30 June 2016

NASA Glenn Research Center h2windbus

Bicycle Program

NASA Kennedy Space Center
EV Charging Station

NASA Langley Research Center

DC Metro System for NASA Headquarters and NASA Goddard Space Flight Center
National Aeronautics and Space Administration (NASA) Multimodal Access Plan (MAP)

Pursuant to E.O. 13693, Planning for Federal Sustainability in the Next Decade

NASA MAP Introduction

Executive Order (E.O.) 13693, Planning for Federal Sustainability in the Next Decade, Section 7(f), requires Federal agencies to consider the development of policies to promote sustainable commuting and work-related travel practices for Federal employees. Where consistent with agency authority, Federal appropriations and other law, this guidance suggests the following strategies:

- Increased telecommuting and teleconferencing
- Incentivizing carpooling and the use of public transportation
- Bicycling and other forms of active commuting
- Workplace electric vehicle charging

The EO 13693 guidance requires agencies to develop a Multimodal Access Plan (MAP) to guide implementation of these strategies. Accordingly, this MAP provides a framework for the following sustainable commuting and workplace travel strategies for NASA and its Centers as potential options for implementation:

I. Telecommuting and Teleconferencing Expansion Strategy (TTES)
II. Carpooling and Transit Expansion Strategy (CTES)
III. Bicycling and Active Commuting Strategy (BACS)
IV. Workplace Charging Strategy (WCS)
V. Walkability Strategy (WS)

The NASA MAP provides a flexible strategic framework to help NASA Centers through the process of building a campus-level plan based on one or more commuting strategies. In addition to those included within this plan, Centers are encouraged to consider their own strategies to the extent that they best fit their particular objectives and needs. Examples from available guidance, literature, and individual Centers should enable NASA to leverage existing knowledge, promote applicability across the agency and inform future updates of the MAP. This MAP should not be considered guidance or directive. Future versions are expected to include more directive guidance after the various strategies are further developed.

NASA and other Federal agencies with a presence in the National Capital region have already developed site-specific employee commuting plans in the past under EO 12191. This document serves as a new agency-level plan, per the requirements of EO 13693. However, successful commuting strategies take more detailed local opportunities and constraints into consideration. Therefore, this MAP serves to assist NASA Centers, agency-wide, in implementing their own strategies in accordance with individual mission, culture, and regional transportation requirements and limitations.

The NASA MAP was developed and implemented under the supervision and approval of the agency Chief Sustainability Officer and other NASA Headquarters (HQ) staff. It was submitted in conjunction with the agency’s annual Fiscal Year (FY) 2016 Strategic Sustainability Performance Plan (SSPP). A Council on Environmental Quality (CEQ) working group is examining updates to the existing 2012 Greenhouse Gas (GHG) Accounting and Reporting Guidance and Technical Support Document. This effort may lead to improved tracking of commuting methods. To further develop its MAP in future years, NASA will monitor these updates, along with changes to the Office of Management and Budget (OMB) "Reduce the Footprint" policy and National Strategy for the Efficient Use of Real Property plan.
NASA MAP Overview

I. Objectives

A significant majority of federal employees commute alone by car today, adding to roadway congestion, personal strain, and negative consequences for the natural environment. Through this MAP, NASA aims to incentivize its workforce of civil servants and contractors, as well as partners that routinely access NASA property, to make cost-effective and environmentally sound commuting decisions that promote greater safety and convenience and improved health.

II. Current Circumstances and Toolsets

Each Federal agency will face its own set of opportunities and challenges in establishing and implementing successful MAP strategies. Among the most prominent considerations for NASA involves the wide variety of locations in both suburban and rural locations that limit the uptake of various transit alternatives versus driving alone in a personally-owned vehicle (POV). NASA Centers also differ greatly in their spatial extent and arrangement. The following image illustrates the diversity of NASA sites in terms of size and density.

![Image illustrating the diversity of NASA sites in terms of size and density.](image)

NASA recognizes the advantage of developing policies that are consistent with the specific needs of its Centers and workforce. To help address these differing circumstances, this MAP includes four separate areas of strategic focus. The MAP will also utilize a few common implementation tools. Most importantly, the NASA Biennial Commuter Survey (NBCS) is used to collect survey responses at the individual level and provides insight into accomplishments at each Center. This has included the ability to quantify the emissions reductions to date due to telecommuting programs, flexible work scheduling, and use of hybrid vehicles. The NCBS also collects data on preferred methods of commuting, desired commuting incentives, and general employee awareness of alternate commuting methods.
Through the NCBS process, NASA has also collected an extensive set of suggestions and other ideas for improving commuting options for all of its Centers across the nation. Some comments and identified opportunities and challenges include the following:

- Overall, NBCS respondents support efforts to reduce Scope 3 GHG emissions from commuting
- Many respondents strongly support telecommuting, when possible with respect to mission requirements, and made suggestions for improving associated policies and procedures.
- Employees benefit from regional housing or offices near Centers; regional shuttles, park and ride, and teleworking offices; and satellite locations or parking for Federal workers
- Larger Centers noted the need for a POV for transit during the day to other areas of the Center
- Respondents who cited the need for the flexibility of having a POV most often referenced irregular work hours or child care and school transportation requirements
- The need for transport services and systems to promote on-site options other than POV, such as hybrid buses or a tram, etc.
- Other ideas included contests for greenest Center, additional master planning coordination, and university-based commuting hubs

NASA will also leverage its regular working group activities, including the Center Sustainability Officer (CSO) video teleconference meetings and SSPP team meetings to understand challenges at individual Centers and across the agency. The NASA Energy and Environmental Functional Review (EEFR) process generates additional data that the ETCT can use to evaluate MAP strategy successes. NASA also carries out weekly meetings between Energy, Environmental, and other staff members that offer the opportunity to discuss MAP developments on an as-needed basis. Finally, some Centers have had success utilizing focus groups to better understand commuting from a master planning perspective.

III. Roles and Responsibilities

A successful NASA-wide commuting plan will require teamwork at multiple organizational levels across the Agency. Assignment of specific responsibilities will follow from an active learning process over the coming year as NASA explores and evaluates initial strategies, engages partners, and reviews pending CEQ and Department of Transportation (DOT) guidance. In general, duties could involve the following:

- NASA HQ managers set policies, develop new and expand existing toolsets, guide the application of Agency resources, and monitor and report Agency-level progress
- Field Center managers confer on existing efforts and propose, advocate, and implement future initiatives suited to their diverse circumstances
- All managers and their commuting champions participate together in assessing, prioritizing, and communicating initiatives, policies, and best practices

NASA will promote broad management support for MAP strategies and measurable goals through creation of an Employee Transportation Coordination Team (ETCT) – to be assembled in FY 2016, this represents the foremost action for NASA in its first year of MAP implementation. The ETCT will carry out its duties in accordance with the needs of NASA, Agency-wide, as well as its individual Centers and employees. Timelines for accomplishing additional actions currently depends upon pending guidance in many cases, so this initial MAP provides a roadmap for setting more definitive objectives in subsequent years. For NASA, this process will include the following steps in the coming 12-months period:

1. Fully assess coordination requirements for proposed strategies within this initial NASA MAP, including network pathways throughout HQ and the Centers, and create the ETCT to assist in meeting associated plan objectives
2. Carry out the NBCS and ensure that the ETCT has access to this and all other relevant commuting data for consideration over the next 12 months
3. Equip the ETCT with additional guidance and other information required to assemble an Agency-wide list of possible actions for each MAP strategy subsection.
4. Through the ETCT, document and prioritize the Agency-wide list of actions across all strategies, such primary areas of focus for the following year versus those requiring a longer timeframe.

When necessary, the ETCT will also coordinate with CEQ, OMB, Federal Regional Councils, and Federal agencies, such as the General Services Administration (GSA) and the Department of Energy (DOE). This effort will also involve coordination with external organizations in many cases (e.g., the National Capital Planning Commission and Washington Metropolitan Area Transit Authority in the Washington, DC metropolitan area). The ETCT will also monitor corresponding requirements between the MAP and relevant emergency preparedness plans or other sustainability requirements that affect commuting.

As part of NASA’s effort to meet EO 13693 greenhouse gas (GHG) targets, the ETCT will determine (to the best of its ability) the effect of MAP strategies on Scope 3 emissions reductions. This could be carried out through analysis of the annual NBCS or other data sources. As part of overall SSPP coordination, the ETCT may also monitor interaction between MAP strategies and ongoing energy and transportation management goals or climate adaptation and associated NASA risk management strategies (for example, challenges in using public transportation when more frequent heatwaves place stress on rail systems).

**IV. Overall Performance Indicators**

The measurement of success in the achieving MAP objective will involve an iterative process for NASA as additional Federal guidance becomes available. In general, NASA hopes to reduce Scope 3 GHG emissions through programs that support mission objectives and allow employees a productive work atmosphere. Meeting these broad initial goals is possible through a general understanding of available transportation infrastructure and programs across the Agency, as well as frequently used commuting methods at individual Centers. Pending forthcoming CEQ and other supplementary guidance, NASA may be able to put in place more quantifiable goals, such as those related to:

- Parking Ratios
- Average Vehicle Occupancy
- Average Employee Commuting Distances
- Commuting Distance by Mode
- Costs and Savings for NASA and its Employees

As the NASA MAP matures over time, preferred strategies and goals will follow. These will require a more detailed understanding of commuting opportunities and limitations, Center preferences, potential alternative commuting methods, and other factors yet to be determined. In the interim NASA will begin implementing initial strategies. During this time, NASA and its Centers can prioritize goals through essential interaction with Federal and community partners, investigation of current transit and onsite infrastructure limitations, and testing methods for promoting employee engagement.

**V. Overarching Strategy Guidelines**

This plan includes an outline of potential commuting strategies at differing levels of specificity. Unique strategy options can all help NASA improve its employee commuting practices and meet GHG reduction goals, but each follows from a more general set of guidelines that drive towards the overall objective set forth for this MAP. This overarching set of NASA strategies includes:

- Maximizing the range and extent of commuter alternatives to driving to work alone through education and communication, and through plan initiatives that incentivize desired changes
Assembling a toolset of initiatives from which local managers can choose in consideration of their diverse mission requirements and geographical considerations

Equipping managers with relevant data and suggested processes to assess circumstances, to know of best practices and models, to evaluate and prioritize implementation of useful initiatives, and to monitor progress

VI. Specific Strategy Initiatives

This MAP contains five potential initiatives, or “strategies,” for consideration in executing the plan to meet NASA’s overall objectives. These strategy opportunities will continue to evolve. Those outlined here in the current iteration provide a starting point for Agency-wide discussion and collaboration and provide an initial framework that NASA intends to build upon over time. Initial proposed strategy opportunities include:

- Telecommuting and Teleconferencing Expansion Strategy – expanding the ability to work from anywhere by building upon Information Technology (IT) strategies that prioritize mobility together with human capital strategies that enable and promote telework and reduce commuting
- Carpooling and Transit Expansion Strategy – promoting carpooling, vanpooling, and public transit solutions through employee incentive programs and by further developing partnerships with regional transit organizations
- Bicycling and Active Commuting Strategy – expanding NASA’s current “Agency Bicycling and Active Commuter Program” through infrastructure support and educational programs
- Workplace Charging Strategy – enabling employees to charge zero-emission automobiles onsite while at work
- Walkability Strategy – promoting denser, more walkable workplaces, featuring complete streets and transit-oriented, mixed-use development to the extent practical

The following section discusses each of these options in greater detail to assist NASA Centers in selecting strategies that fit their individual needs.
NASA MAP Strategy Areas

I. Telecommuting and Teleconferencing Expansion Strategy

The MAP implementing instructions for EO 13693 call for agencies to consider planning for the facilitation of activities to increase telecommuting and teleconferencing. A Telecommuting and Teleconferencing Strategy (TTES) can help NASA succeed in doing this, and associated options are discussed below. A TTES can also be an effective means of reducing Scope 3 emissions, and for improving the quality of work and life experiences for NASA employees. The following TTES elements and examples are provided to assist Centers considering MAP options. Centers can also consider other elements and examples that best fit their needs.

This flexible strategy framework should not be considered guidance or directive, nor does it establish any required tasks for FY 2016. Future MAP versions are expected to include more directive guidance after the various strategies are further developed and prioritized.

A. Summary of Strategy:

In pursuit of sustainability goals and travel cost savings, NASA has already implemented telecommuting and teleconferencing policies at the Agency-wide and Center levels. In addition, through the NBCS, NASA has gathered feedback from its workforce on opportunities and challenges related to existing telecommuting and teleconferencing programs. NASA also values face-to-face interaction and continues to investigate different ways of managing time spent in the office to maximize performance and collaboration. A TTES can promote expansion of remote interaction programs in keeping with these considerations, its mission, and needs of each Center.

Many respondents to the NBCS have indicated a willingness to telecommute and teleconference more frequently, when practical. NASA continues to investigate this interest and may review alternate arrangements including satellite offices. Some challenges remain in gathering required support for expanding these efforts. Most importantly, mission requirements often present a barrier to telework and flexible scheduling, and remote interaction does not suffice. Resistance also can result from a perceived inability to monitor productivity remotely. In addition, policymaking across different Mission Directorates operating at a given Center can complicate telework arrangements. A TTES can support a workplace environment that encourages remote interaction whenever productive, beneficial and practical.

NASA continues to identify employees for which remote interaction allows for efficient completion of their duties. Given the high level of autonomy across individual NASA Centers, management support for TTES options will continue to depend on individual programmatic circumstances and preferences. Coordination of these efforts can take place at the Center level with ETCT guidance and support.

B. Details of Strategy:

Telecommuting

The ETCT will help to champion telecommuting strategies in partnership with other team members, such as Human Relations (HR), legal staff, and union representatives. This effort will include communication with Agency and Center management to incorporate mission-based limitations and make guidance and information accessible for available programs. For example, the Commuter Choice program offers tax-free benefits and shared commuting cost opportunities for Federal employees.

Telecommuting strategies may take into consideration the following:

- Reviewing NBCS data or holding Center focus groups to gauge interest in expanding telework
- Establishing or improving telework agreement contracts and other policies
- Considering “hoteling” options at Centers where employees have longer commutes
• Implementing mandatory telework as a component of Continuity of Operations Plans (COOP)
• Gauging required accommodations for employees that cannot telecommute

Flexible Scheduling
In some cases teleworking and teleconference capabilities are limited by mission requirements, responsibilities of individual positions, security concerns, and technological limitations related to communications. Accordingly, a TTES could include schedule-based changes, such as “Flex Fridays,” where employees can take every other Friday off and work longer days (also referred to as a 9/80 schedule). In some cases options could also include four-day, ten-hour schedules, or other arrangements.

Flexible scheduling can benefit Federal agencies through improved job satisfaction and work-life balance. In many individual situations NASA employees can complete required assignments while their management accommodates a flexible schedule. Centers can look into available opportunities for those interested in flexible scheduling. Centers can also investigate strategies that include required alternative scheduling, as necessary, such Center-wide telework days in the event of Code Orange or Code Red Air Quality Index days.

Flexible work strategies may take into consideration the following:
• Addressing impacts to union agreements and other legal considerations
• Managing performance expectations through formalized agreements at the NASA-wide, Center, and individual employee levels
• Investigating IT infrastructure capabilities and potential improvements
• Determining the need for particular work hours (e.g., 9 AM to 3 PM) or certain days of the week where all employees must be in attendance

1. Actions and Projected Timeframes
NASA will assess the status of any ongoing and newly developed TTES elements through the NBCS process for FY 2016. This will take place as part of the annual GHG reporting process in the first half of FY 2017, and findings will be incorporated into the updated FY 2017 MAP as part of the FY 2017 SSPP. This timeframe covers all specific actions as laid out in the detailed strategies above.

2. Roles and Responsibilities of Key Agency Personnel
Under guidance of the ETCT, NASA can promote TTES options in coordination with other functional teams involved in decision-making on remote work strategies. This process could include teamwork with IT and human resource personnel, among others, and the TTES requires final approval through the annual CSO review process.

3. Outreach to Agency Employees
NASA can help promote selected TTES elements through the following outreach efforts:
• Distributing guidance for managers and telecommuters
• Making links available to internal and external resources
• Solidifying program acceptance through formal or informal trainings

4. Incentivizing Increased Telecommuting and Teleconferencing
NASA can incentivize TTES elements through several means, including the following:
• Developing cost savings estimates for telecommuting and posting this information online
• Disseminating information on commuting time saved through remote work and traffic avoidance enabled by flexible work opportunities
• Helping employees understand the increased flexibility afforded by the TTES

5. Assessing Demand for Telecommuting and Teleconferencing
NASA can assess demand for TTES options through the NBCS and Center focus groups at the level.
6. Ensuring Continued Success

NASA gauges the effectiveness of TTES elements through multiple iterations of the NBCS. NASA also reviews success stories through regular meetings of the Workplace Strategies group to promote TTES opportunities that meet the needs of the Agency and individual Centers.

C. Resources:

The following resources are available for TTES implementation:

- NASA Workplace Strategies documentation

II. Carpooling and Transit Strategy

The MAP implementing instructions for EO 13693 call for agencies to consider new strategies to incentivize carpooling and the use of public transportation to and from Federal facilities including for vehicle sharing programs. A Carpooling and Transit Expansion Strategy (CTES) can help NASA succeed in doing this. A CTES can also be an effective means of reducing Scope 3 emissions, and for improving the quality of work and life experiences for Federal employees and visitors of Federal agencies. The following CTES elements and examples are provided to assist Centers considering MAP options. Centers are also encouraged consider other elements and examples that best fit their needs.

This flexible strategy framework should not be considered guidance or directive, nor does it establish any required tasks for FY 2016. Future MAP versions are expected to include more directive guidance after the various strategies are further developed and prioritized.

A. Summary of Strategy:

NASA Centers operate within a wide variety of campus configurations and communities. Some are located in urban areas, while others are more remote and rural. This impacts all MAP strategies, but based upon NBCS responses these differences create challenges most acutely in relation to Agency-wide CTES options. Many respondents noted the lack of any practical mass transit options in their area. Though this sentiment carries through Centers in both urban and rural settings, the reasons differ greatly. Many urban Centers have indicated that inconsistent performance of public transit systems limits the ability to rely on these transportation methods for commuting. On the other hand, Centers in more rural locations have limited or no options for public transportation.

An overarching concern among many NBCS respondents involves the need for POV flexibility to accommodate irregular work hours, transportation onsite between distant buildings, and children’s schedules. Others felt that increased subsidy programs for public transportation, carpool, and other environmentally friendly commuting options could help them chose these methods. At one Center many respondents commented on the long wait time to access the gate and would benefit from regional hoteling options.

Potential solutions to these challenges also differ greatly across NASA’s Centers. EO 13693 promotes several strategies to incentivize carpooling and the use of public transportation to and from Federal facilities. For instance, ideas include “real time transit screens in Agency common areas, and leveraging public-private partnerships as appropriate, including for vehicle and bicycle sharing programs.” Alternatively, Section 3(h)(vi) offers long-term planning guidance to “improve building efficiency, performance, and management by including in the planning for new buildings or leases consideration of existing community transportation planning and infrastructure, including access to public transit.”

In keeping with this guidance and pending updates, CTES options will encourage carpooling and public transportation strategies in keeping with the challenges at particular Centers and for individual employees.
This effort can include parking management programs in addition to travel allowances and restrictions. Centers may also consider setting up an online commuter resource page to help employees navigate the complex set of available options and provide a one-stop location for accessing related guidance, support materials, and links to other organizational websites.

B. Details of Strategy:

Carpooling, Vanpooling and Other Ridesharing

Some NASA employees already take advantage of carpool and vanpool opportunities. Others indicated a great interest in supporting this type of strategy due to the remote location of their facility, as mass transit options are not available. Some commenters indicated the same but that flex schedules make carpooling difficult as this option is typically limited to regular hours. The development of these strategies may take each of these considerations into account.

Carpooling and vanpooling strategies may also take into consideration the following:

- Developing an application (app) or other method of matching carpoolers and vanpoolers
- Incentivizing carpooling and vanpooling by providing or improving subsidies
- Provide non-monetary incentives such as preferred parking
- Investigate the use of third-party vanpool providers as primary or back-up services
- Track ridership to allow for more detailed analysis of route matching opportunities and identification of carpools or vanpools that need additional riders
- Organizing informal events where riders from the same area can meet
- Expanding carpool opportunities through the use of Agency shuttle buses to transport employees from the primary transport corridors employees use
- Addressing safety concerns through carefully managed driver approval processes
- Establishing an Agency-wide online dashboard of available ridesharing tools

Public Transportation

For some NASA Centers in highly remote locations, public transportation is not a viable option. In these cases some NBCS respondents indicated they would appreciate a NASA bus system to transport employees to the Center from central locations in the region, coupled with improved onsite transport services. Several Centers have had shuttle services to mass transit sites in the past, but had to discontinue these services over the past decade due to budgetary pressures. Many respondents also expressed frustration that the final leg of mass transit to Centers is either not available or extremely inconvenient (at both ends of the trip, sometimes referring to this as the “the last mile problem”). In some regions NBCS respondents noted reliability issues with public transportation systems, and these issues have likely led to decreased ridership.

Source: Washington DC Metrorail Ridership (WMATA)
Public transportation strategies may take into consideration the following:

- Considering shuttle buses to NASA from major public transportation nodes at Centers where mass transit options for the region do not connect closely
- Modeling private company systems, such as bus systems used by large technology firms
- Partnering with other agencies or organizations to share their transportation systems
- Negotiating changes in routes or stops to improve public transportation services
- Providing or expanding on-site transportation between Center buildings
- Investigating ways of increasing public transit subsidies
- Offering routes between NASA locations, such as HQ and Goddard Space Flight Center
- Encouraging Center-wide transit and carpool days
- Considering “guaranteed ride home” services or taxis in case of public transit shutdowns

1. Actions and Projected Timeframes

NASA will assess the status of any ongoing and newly developed CTES elements through the NBCS process for FY 2016. This will take place as part of the annual GHG reporting process in the first half of FY 2017, and findings will be incorporated into the updated FY 2017 MAP as part of the FY 2017 SSPP.

2. Roles and Responsibilities of Key Agency Personnel

Under guidance of the ETCT, NASA can promote CTES options in coordination with other functional teams involved in related decision-making. This process could include teamwork with IT and human resource personnel, among others, and working with external partners like regional public transportation organizations. The CTES requires final approval through the annual CSO review process.

3. Outreach to Agency Employees and Visitors

NASA can help promote CTES options through the following outreach efforts:

- Developing online commuter information portals with links to documentation on fares, safety and insurance considerations, etc.
- Schedule classes or online presentations for employees to learn about CTES opportunities
- Providing contact information for questions directed to the ETCT
- Announcing vanpool routes as they become available
- Making the CTES part of the new employee onboarding process
- Educating employees on the health benefits of transit for employees

4. Incentivizing Carpooling and Transit usage

NASA can incentivize CTES options through several means, including the following:

- Providing monetary benefits, including transit and vanpool subsidies
- Providing non-monetary benefits, such as priority parking spaces for carpools
- Providing employees with information on potential cost savings from reduced costs associated with automobile ownership
- Working with Federal Agency representatives on transportation boards to negotiate better benefits for NASA employees

5. Assessing Demand for Carpooling and Transit Services

NASA can assess demand for CTES options through the NBCS process and focus groups at the Center level. Regular CSO meetings can allow for additional information sharing.

6. Ensuring Continued Success

NASA gauges the effectiveness of CTES elements through multiple iterations of the NBCS. NASA also reviews success stories through regular meetings of the Workplace Strategies group to promote CTES opportunities that meet the needs of the Agency and individual Centers.
C. Resources:
The following resources are available for CTES implementation:
- The American Public Transportation Association’s publication “Evaluating Public Transportation Health Benefits” can provide Federal agencies with useful information for their employees about the health benefits of using transit
- National Capital region: [http://www.hq.nasa.gov/hq/commuter_corner.html](http://www.hq.nasa.gov/hq/commuter_corner.html) and Commuter Connections
- Other local Center community resources, such as:
  - Ames Research Center: [http://employeeorientation.nasa.gov/ames/services_facilities.htm](http://employeeorientation.nasa.gov/ames/services_facilities.htm)

III. Bicycling and Active Commuter Strategy

The MAP implementing instructions for EO 13693 call for agencies to consider recommendations from the revised Interagency Task Force on Bicycling and Active Transportation report (forthcoming in 2016), and to offer employees reimbursement for bicycling under the Qualified Transportation Fringe Benefits tax provision. Establishing an Agency Bicycling and Active Commuter Strategy (BACS) is a good way for NASA to address task force recommendations and implement tax and other incentives for employees and visitors. A successful BACS can also be an effective means of reducing Scope 3 emissions, and for improving the quality of work and life experiences for employees and visitors. The following BACS elements and examples are provided to assist Centers considering MAP options. Centers can also consider other elements and examples that best fit their needs.

This flexible strategy framework should not be considered guidance or directive, nor does it establish any required tasks for FY 2016. Future MAP versions are expected to include more directive guidance after the various strategies are further developed and prioritized.

A. Summary of Strategy:

NASA has gauged employee interest in active commuting through the NBCS process. Several NASA Centers already have well-established bicycling infrastructure and active commuting programs in place. At these Centers, respondents to the NBCS note the critical importance of safe routes to work and amenities such as secure bike storage areas and shower facilities. In general, these employees are at NASA’s Centers located in more urban areas. BACS options for these Centers might include expanding incentive programs.

Other Centers, such as those in rural areas, face greater challenges in promoting active commuting methods. Many NBCS respondents at these Centers support biking to work; however, they often note a lack of safe routes or required infrastructure. Many employees at these locations that lack biker-friendly commuting routes have the opportunity to ride NASA-issued or personal bicycles onsite during the day to navigate the Center campus. A BACS can encourage expansion of active commuting strategies in keeping with infrastructure-based and other challenges at particular Centers and for individual employees.

B. Details of Strategy:

Active Commuting Infrastructure

NASA will review updates to *Implementing a Successful Bicycle and Active Commuting Program in the Washington, DC Metropolitan Area*, forthcoming in FY 2016. In development by the Interagency Task Force on Bicycling and Active Transportation, these updates are slated to include an expansion to other metropolitan areas with major Federal offices and facilities. These strategies may include providing for additional active commuting infrastructure.
Active commuting infrastructure strategies may take into consideration the following:

- Addressing lane management – work with transportation coordinators on new safe bike routes or dedicated bike lanes, or on adding sidewalks where necessary for pedestrians
- Improving bicycle storage or parking infrastructure, such as additional bike racks
- Providing easier locker access or facilities for showering, especially at Centers with warmer and more humid climates
- Configuring entrance areas to accommodate biking and walking as another primary means of accessibility to the Center
- Providing additional amenities onsite that discourage the need for a car during the day

**Other Active Commuting Policies**

Strategies in the updated guidance from the Interagency Task Force on Bicycling and Active Transportation may also include improvements not related to infrastructure – for example, offering Federal employees commuting reimbursement for bicycling, pursuant to 26 U.S.C. § 132 (f)(1)(D). NASA will review forthcoming guidance from CEQ and OMB on administering commuter transit subsidies to encourage more bicycle trips, as well as other BACS opportunities.

Other active commuting policies may take into consideration the following:

- Taking advantage of Federal subsidies for bicycle commuters
- Offer bicyclists and walkers additional monetary incentives, such as seeking out group discounts towards bicycle sharing organization memberships
- Considering non-monetary incentives, such as priority parking on one non-active commuting day per week for those that engage in active commuting on other days
- Working with public transit authorities (e.g., D.C. Metro) to promote mixed-mode commuting, such as incentivizing bicycle-to-bus by decreasing outdoor wait times
- Encouraging employees to participate in regional bike-to-work days

**1. Actions and Projected Timeframes**

NASA will assess the status of any ongoing and newly developed BACS elements through the NBCS process for FY 2016. This will take place as part of the annual GHG reporting process in the first half of FY 2017, and findings will be incorporated into the updated FY 2017 MAP as part of the FY 2017 SSPP. Timeframes and specific actions also depend upon the release date of pending DOT guidance.

**2. Roles and Responsibilities of Key Agency Personnel**

Under guidance of the ETCT, NASA can promote BACS options in coordination with other functional teams involved in decision-making on active commuting strategies. This process could include teamwork between the Office of Strategic Infrastructure and Office of Human Capital Management, among others. It also involves working with external partners like GSA and regional public transportation organizations. The implementation of the BACS options will require final approval from the Chief Sustainability Officer and Center Directors.

**3. Outreach to Agency Employees and Visitors**

NASA can help promote BACS options through the following outreach efforts:

- Distributing area maps focused on active commuting paths
- Promoting use of available bike-share programs in the region, including identification of pick-up and drop-off locations
- Informing employees and visitors about available guidance including literature from NASA and external organizations
- Providing classes or online training courses on active commuting safety
A NASA employee at Glenn Research Center demonstrates how when passing is not safe, cyclists should move to center or left-center of the lane to prevent or deter unsafe passing. Guidance indicates that when a motorist tries to pass anyway, signaling "don't pass" with your left hand can help prevent such hazards.

http://www.nasa.gov/centers/glenn/news/AF/2008/July08_BikeSafety.html

Credit: NASA/Doreen B. Zudell (SGTI)

4. Incentivizing Bicycle Usage and other Forms of Active Commuting

NASA can incentivize BACS options through several means, including the following:

- Developing cost savings estimates and beneficial health impact assessments for active commuting and posting this information online
- Utilizing the Qualified Transportation Fringe Benefit, DOT’s Active Bicycle Commuting Subsidy, and other monetary and non-monetary incentives mentioned in the detailed strategy section above
- Organizing team-based challenges or competitions for active commuting

5. Assessing Demand for Bicycle and other Active Commuter Needs

NASA can assess demand for BACS options through the NBCS process and focus groups at the Center level. Use of bicycle tracking could also allow for better demand assessment and management of incentive programs.

6. Ensuring Continued Success

NASA gauges the effectiveness of BACS elements through multiple iterations of the NBCS. NASA also reviews success stories through regular CSO meetings to promote BACS opportunities that meet the needs of individual Centers.

C. Resources:

Several resources are available for BACS implementation:

- DOT’s forthcoming “Implementing a Successful Bicycle and Active Commuting Program” will provide information to support BACS establishment. Centers are encouraged to use this as a resource when considering their BACS options.
- Center websites offer examples of success stories on active commuting programs (e.g., http://www.nasa.gov/centers/langley/news/researchernews/rn_bikecommute.html)
- Regional bike-sharing programs (e.g., Capital BikeShare in Washington, DC)

IV. Workplace Charging Strategy

The MAP implementing instructions for EO 13693 call for agencies to consider planning for appropriate workplace charging capabilities. Forthcoming CEQ guidance on workplace charging provisions of the Fixing America’s Surface Transportation (FAST) Act will provide NASA a framework for providing and being reimbursed for workplace charging used by employees and authorized users for their privately owned electric vehicles. A Workplace Charging Strategy (WCS) can help NASA succeed in implementing this framework. The following WCS elements and examples are provided to assist Centers considering MAP options. Centers can also consider other elements and examples that best fit their needs.
This flexible strategy framework should not be considered guidance or directive, nor does it establish any required tasks for FY 2016. Future MAP versions are expected to include more directive guidance after the various strategies are further developed and prioritized.

A. Summary of Strategy:

NASA has noted significant demand for workplace charging at several Centers and has already been working to develop implementation strategies for employee electric vehicle (EV) charging. Many NBCS respondents support installation of charging stations for electric vehicles, either with a self-pay option or government subsidy (detailed cost reimbursement impacts and other considerations were not addressed). This included significant interest at six of NASA’s Centers, inclusive of those located in both urban and rural settings, and general interest across the Agency. Some options have already been explored, as the following figure illustrates – an analysis of available EV parking lots and associated charging infrastructure conducted at one Center in FY 2014:

http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20140003463.pdf

Section 1413(c) of FAST authorizes GSA and other Federal agencies to install and operate plug-in electric vehicle (PEV) charging stations for privately owned PEVs in parking areas used by Federal employees and authorized users, and provides for the collection of fees to recover these costs. Guidance specific to Level 1 (120V electrical outlets) has already been provided, and Level 2 (240V charging stations) guidance is forthcoming. These guidance materials intend to enable simple and easily administered implementation of workplace charging in a cost-effective and safe manner.

B. Details of Strategy:

Through WCS options, NASA and its Centers can promote sustainable commuting practices through the use of personal PEVs. Upon release of remaining guidance for Federal Agencies, NASA will review the best implementation methods available for provision of metered Level 1, metered or un-metered Level 2, or DC Fast Charging stations. In the interim, however, there are several steps that NASA Centers can consider taking to move forward using existing guidance.

WCS options may take into consideration the following:

- Recognizing onsite locations where Level 1 and Level 2 capabilities are established
- Reviewing how major construction and repair projects offer opportunities to implement PEV charging infrastructure and related signage/markings at a lower cost
• Procuring charging stations and, where possible, infrastructure that will allow for vehicle level data reporting capabilities
• Determine expected design-life implications and O&M costs associated with WCS practices
• Negotiating with leased space owners to make existing outlets available for EV charging or otherwise install, operate, and maintain charging infrastructure
• Identifying vendors that offer to install, own and operate EV charging at no expense to the property owner (other than use of existing junction box capacity and parking spaces)
• Studying how Agency fleet requirements related to plug-in hybrid vehicles will impact the ability to support privately owned PEVs [per EO 13693 section 3(g)(v)]
• Assessing any maintenance, operation, safety and security procedures

1. Actions and Projected Timeframes

NASA will assess the status of any ongoing and newly developed WPC elements through the NBCS process for FY 2016. This will take place as part of the annual GHG reporting process in the first half of FY 2017, and findings will be incorporated into the updated FY 2017 MAP as part of the FY 2017 SSPP. NASA has also held meetings of HQ working groups to assess progress and plan ongoing actions. Timeframes also depend upon the release date of pending CEQ guidance.

2. Roles and Responsibilities of Key Agency Personnel

Under guidance of the ETCT, NASA can promote WPC options in coordination with other functional teams involved in decision-making on active commuting strategies. This process could include teamwork with the NASA Fleet Manager, Facilities and Real Estate Division and the Office of Human Capital, among others, including working with external partners like GSA and private sector infrastructure vendors. The WPC requires final approval through the annual CSO review process.

3. Outreach to Agency Employees and Visitors

NASA can help promote WPC options through the following outreach efforts:
• Quantifying the benefits of PEV commuting and providing this information to employees
• Providing Center success stories through the Sustainability Working Group (SWG) video teleconference meetings and other meetings (e.g., Kennedy Space Center [KSC] Greenhouse Gas [GHG] Scope III Emissions Pilot Project)
  
• Developing classes or online training on safety and other operational considerations of EVs

NASA parking lot flooding from a monsoon. This photo highlights the need to consider potential safety issues with siting charging stations on flat parking lots subject to storm water flooding (many Centers are located on flat coastal plains).

http://www.nasa.gov/centers/langley/multimodia/iotw-monsoon-sept2010.html

Credit: NASA/Sean Smith

4. Incentivizing EV Usage

NASA can incentivize WPC options through several means, including the following:
• Providing employees with information on Federal, State, and local EV tax credits and rebates
• Adding signage to both alert EV drivers and promote the fact that Electric Vehicle Supply Equipment (EVSE) is available for use of Federal employees and authorized users
• Making employees and authorized users aware of benefits from rates they can pay to use charging infrastructure at Federal parking facilities

5. Assessing Demand for Workplace Charging Needs
NASA has already made an effort to assess demand for WPC options at its Centers. NASA can continue this process through the NBCS process and focus groups at the Center level. Use of EV charging permits, per pending CEQ guidance, could also allow for better demand assessment and management of incentive programs.

6. Ensuring Continued Success
NASA gauges the effectiveness of WPC elements through multiple iterations of the NBCS. NASA also reviews opportunities through regular SWG video teleconference meetings to promote WPC strategies that meet the needs of individual Centers. Strategies could begin with deploying or using existing unmetered, level-one (UML1) EV charging facilities, followed by metered and faster EV charging strategies as appropriate.

C. Resources:
Several resources are available for WPC implementation:
• DOE’s Workplace Charging Challenge website has numerous resources to help guide an Agency through the development of a WPC. DOE encourages agencies to join as a partner of the Workplace Charging Challenge in order to gain additional technical assistance.
• CEQ guidance for unmetered, level one charging (UML1) for Federal employees and authorized users, and pending guidance for metered level one, and level two and DC Fast Charging.
• Available literature from other government agencies (e.g., GAO opinions, DOE Clean Cities), academic institutions, and the private sector sources to supplement pending CEQ guidance

V. Walkability Strategy
In addition to those suggested by CEQ, NASA recognizes and prioritizes other site strategies that enable or expand alternatives to driving to work alone. For example, a Walkability Strategy (WS) can help NASA succeed in this endeavor by limiting the need for a POV onsite. A WS can also be an effective means of reducing Scope 3 emissions, and for improving the quality of work and life experiences for Federal employees and visitors of Federal agencies. Potential elements of a WS could include:

• Compact or mixed use development
• Complete streets
• Proximity to public transit (parallels the CTES)
• Bike lanes, racking, and changing facilities (parallels the BACS)

This flexible strategy framework should not be considered guidance or directive, nor does it establish any required tasks for FY 2016. Future MAP versions are expected to include more directive guidance after the various strategies are further developed and prioritized. NASA will work to develop a more detailed set of guidance materials for this strategy. This process could include referencing master planning and facilities design standards or other ongoing NASA programs that support walkability. NASA’s master plans promote denser, more walkable workplaces, featuring complete streets and transit-oriented, mixed-use development to the extent practical.
Plan Management and Evaluation

Successful transportation planning requires iterative programmatic evaluation and improvement. This will require collection of applicable information through the NBCS process and other data-driven, top-down sources. For example, NASA can monitor rates for telework and use of onsite electrical charging stations. Qualitative assessment of employee satisfaction will also be possible through the NBCS, which includes targeted questions and a free-response block. In addition, investigating Center-level success stories will allow for additional engagement and development of iterative improvement opportunities from the bottom up.

NASA will review the success of its MAP and associated Center-level planning efforts through annual emissions tracking with the FEMP GHG Reporting Portal. CEQ has been tasked with evaluating associated GHG accounting methods to provide recommendations for improving the Federal community’s ability to track and analyze emissions associated with employee commuting. This will take place in coordination with GSA, the Office of Personnel Management, DOT, and the Section 10 interagency working group on Sustainable Locations for Federal Facilities. Accordingly, NASA will monitor pending changes to the GHG Accounting and Reporting Guidance and Technical Support Document, Appendix C.5 (Federal Employee Commuting).

Success in reducing Scope 3 GHG emissions, especially through commuting strategies, also involves operations and decision-making by parties outside of NASA’s organizational boundary. Methods for evaluating program success could also include tracking public transportation and other service failures outside of NASA’s direct control. This will help NASA tailor strategies to the needs of its Centers in recognition of the impact external organizations have on successful MAP programs.

NASA will continue promoting strategies provided in the MAP in accordance with the needs of its Centers and mission. The ETCT will apply information gained through monitoring and evaluation of successes and shortcomings. The ETCT may also encourage the appointment of Center commuting champions to further support this effort. Center-level commuting champions can apply strategies that fit the needs of their workforce. This support will include NASA HQ providing access to supplementary guidance for Centers with less mature multimodal transportation planning policies.